THE GOVERNMENT OF THE PHILIPPINE ISLANDS
DEPARTMENT OF AGRICULTURE AND NATURAL RESOURCES
BUREAU OF AGRICULTURE

TWENTY-THIRD ANNUAL REPORT OF THE BUREAU OF AGRICULTURE

FOR THE

FISCAL YEAR ENDED DECEMBER 31, 1923

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TWENTY-THIRD ANNUAL REPORT OF THE BUREAU OF AGRICULTURE

SIR: I have the honor to submit the following annual report of the Bureau of Agriculture for the year ending December 31, 1923. To conform to the crop seasons of the different products, the crop statistics in this report are, however, for years ending June 30.

ECONOMIC AND WEATHER CONDITIONS

During the year under review and especially at the beginning of the planting seasons, the general outcry, particularly among the small farmers, was the scarcity of money. The improvident expenditures and the costly acquisitions made during the period of inflated prices followed by decreased yields in 1921 and 1922 due to typhoons and drought, forced the farmers to assume onerous obligations the payment of which absorbed the small profits obtained if any. To start farm operations small farmers were forced to secure loans at high rates from small capitalists, their lack of proper land titles in many cases barring them from receiving loans from the bank, and these loans were ordinarily paid off with half of their produce, in many instances valued at an amount double the amount loaned or more.

Labor was scarce in many regions especially in the abaca and sugar cane provinces, while in other places the high wages demanded, prevented the planting of large areas and in some towns in Pampanga, Nueva Ecija, and Tarlac conflicts between patrons and laborers delayed the planting of rice and thereby decreased the yields expected. The practice of many laborers of requiring payment of one week wages in advance before going to work in the "lates" of abaca and in many cases of not living up to their agreement after they secure the advance, and the low prices that this fiber commanded lately, have made not a few owners so disgruntled that they would not pay their land taxes and let their property be confiscated by the Government in consequence.

The lack of adequate means of communication and of good roads was a serious handicap to the farmers this year for the

proper distribution of the crops. While this is true every year with the low prices prevalent of late and the great odds they work against, the lack of means of communications and good roads was the most important cause of losses. Due to the lack of passable roads by which isolated towns can be reached, there have been during the year many places inaccessible to labor and, therefore, many tons of rice and sugar were left to rot in the fields, while for the same reason in other regions not a few farmers had to undersell their produce.

There were again this year large swarms of locusts as last year and they damaged many crops especially rice, corn, coconuts, and sugar cane. The worst infestation was registered in the month of July when nearly 400 towns were visited by swarms of locusts. Fortunately the infestation began declining then with the heavy rains. Locusts can not easily migrate in wet weather and the number of towns reported with locusts was about 70 by the end of December, 1922, and less than 30 in March, 1923, when the number began again increasing until there were nearly 300 towns infested at the end of the agricultural year under review. The presence of these swarms also delayed the planting of rice, sugar cane, and corn in some places and decreased the number of cane points in others.

Other plant pests were heart-rot and root-rot or bunchy top which made their appearance in the abaca plantations in some towns of Cavite and Laguna causing damages of some consideration.

The prevalence of epidemic diseases of animals during the preceding year, 1922, continued this year causing serious losses among carabaos and cattle, thus greatly hindering the planting and cultivating of different crops not only because the number left were not sufficient to cultivate the farms, but also because quarantining the animals prevented working many farms.

During the agricultural year reviewed, there were registered not less than nine typhoons in and around the Islands. These were accompanied by heavy rains culminating in floods, making the season one of the rainest on record. These typhoons occurred in the months of July, September, and November, 1922 and January, May, June, and November, 1923, and damaged sugar cane considerably but in general helped palay.

The farmers were not, however, dismayed by the many odds they worked against; they replanted as far as they were able to the flooded areas and those ravaged by locusts thereby greatly minimizing the losses and making a quite remarkable record by

planting for the six leading crops all together a larger area than any year before.

Also as compensation, our farmers secured this year better prices than the last two years for all their products except corn. The highest prices were obtained during the agricultural year 1920, but they declined suddenly in 1921 and dropped still lower in 1922. In the middle of the year under discussion they began rising until the close thereof, with an increase of from 5 to 10 per cent from 1922.

The following table shows for 1903 and from 1910 to 1923 the combined area planted to the six leading crops of the Islands—rice, sugar cane, coconuts, abaca, corn, and tobacco and their aggregate value since 1910, the average value of production per hectare, the average value of production per capita and average area cultivated per 100 population.

TABLE I

Years	Area	Value	Average area cultivated per 100 population	Average value of production per capita	Average value of production per hectare
	Hectares		*Hectares*		
1903	1,170,100		15		
1910	2,256,530	₱137,005,960	25	₱15	₱61
1911	2,148,340	152,501,510	24	17	71
1912	2,303,870	148,347,500	25	16	64
1913	2,361,480	168,633,730	25	18	71
1914	2,579,990	163,496,250	27	17	63
1915	2,522,210	159,055,330	26	16	63
1916	2,531,700	179,241,380	25	18	71
1917	2,691,410	244,179,470	26	24	91
1918	2,918,590	361,940,450	28	35	124
1919	2,974,920	458,698,580	28	44	154
1920	3,276,940	687,131,500	30	64	210
1921	3,515,590	403,258,250	32	37	115
1922	3,429,750	302,143,710	31	27	88
1923	3,495,440	380,194,710	31	33	109

CROP RESULTS

PALAY (ROUGH RICE)

Despite the presence of swarms of locusts, the occurrence of typhoons and the loss of many working animals due to epidemic diseases at the time of planting the seed beds, there was sown during the year under discussion the largest area ever planted to palay in these Islands and the largest crop gathered on record. It was necessary for the farmers to replant the areas destroyed either by typhoons and heavy rains or locust or to delay the planting because of swarms of locusts. It was also necessary to delay the plowing for lack of work animals or because of the anthrax quarantine, but the crops were a success

nevertheless, though it is estimated that the losses from typhoons, heavy rains and locusts reduced the production of this year by 7 per cent.

The total area planted during the year was 1,675,870 hectares against 1,661,430 hectares for the preceding year, or an increase of 1 per cent. The production was 43,790,500 cavans of palay, which is 1 per cent larger than last year, which in turn was the largest crop ever gathered, or 43,436,830 cavans. In the average yield per hectare this year compares identically as last year, 26 cavans, but it was sold at twenty centavos higher per cavan than then or at ₱3.40 and brought to the farmers ₱149,475,950 against ₱139,935,080 the year before.

The ten leading provinces in the production of palay are Nueva Ecija, Pangasinán, Iloilo, Tarlac, Pampanga, Ilocos Norte, Bulacan, La Union, Capiz, and Batangas. During the year there were all together planted 936,280 hectares against 925,980 last year, or an increase of 1 per cent and they produced 28,070,000 cavans this year against 28,129,090 cavans last season, or a decrease of .2 per cent. Comparing the year 1921–22 and this year, these provinces raised 65 and 64 per cent of the total production, respectively, the decrease being in part due to a greater area planted to palay by other provinces—Samar, Leyte, Mindoro, Oriental Negros, Sorsogon, and Surigao which planted 10,990 hectares more this season, and partly due to greater losses from unfavorable weather sustained this year by such leading provinces than last year.

The following table shows the area cultivated, the production, the average yield per hectare, the average price, and the total value of palay in the Islands for 1903 and from 1910 to 1923.

TABLE II

Years	Area cultivated	Production	Average production per hectare	Average price per cavan	Total value
	Hectares	*Cavans*			
1903	592,766	11,465,544	19.34	(a)	(a)
1910	1,192,140	18,859,090	15.82	₱3.01	₱55,765,850
1911	1,043,760	20,530,100	19.67	3.01	61,759,590
1912	1,078,890	11,622,470	10.77	3.44	39,981,290
1913	1,141,240	24,498,860	21.47	2.37	57,939,800
1914	1,244,940	22,736,810	18.26	2.52	57,261,760
1915	1,130,710	17,818,490	15.75	2.76	49,207,980
1916	1,140,830	20,878,860	18.30	2.68	55,923,820
1917	1,225,690	28,276,720	23.07	2.85	81,377,810
1918	1,368,140	35,795,050	26.16	3.77	136,163,370
1919	1,381,340	33,781,650	24.45	5.58	188,614,590
1920	1,484,890	36,343,810	24.48	7.01	254,855,380
1921	1,673,380	41,478,540	24.79	3.78	156,892,680
1922	1,661,430	43,436,830	26.14	3.22	139,935,080
1923	1,675,870	43,790,500	26.13	3.41	149,475,950

(a) Not available.

SUGAR CANE

Due largely to unfavorable weather and scarcity of cane points and partly to lack of money and labor, the area of cultivation of this crop for the 1922–23 season decreased by nearly 6 per cent from 1921–22 and the combined production of sugar and panochas decreased, too, by 11 per cent as a consequence thereof and because of a reduction of 5 per cent in the average yield per hectare for the same reasons.

The area put under cultivation this year was 227,290 hectares against 240,820 last year; and the production was only 6,446,800 piculs of sugar and 370,780 piculs of panocha against 7,200,070 and 447,450 respectively last year. Likewise there was registered a noted decrease in the production of "basi" and molasses, this year the output being only 7,531,230 and 9,876,230 liters, respectively, against 10,537,980 and 21,185,320 liters the year before.

There were, however, during the year reviewed better prices for sugar, panochas and "basi" than last year and this explains why with a smaller production, the total value this year for all sugar cane products was ₱87,831,550 against ₱59,948,250 last year, or an increase of 46 per cent.

The prices for the different products of sugar cane for 1922–23 compared with those for 1921–22 were as follows: sugar, ₱12.74 per picul against ₱7.11; panocha, ₱8 per picul against ₱6.84; basi, ₱19.65 per 100 liters against ₱18.53; molasses, ₱12.50 per 100 liters against ₱13.33.

With the exception of Batangas which planted 2 per cent more hectares this year than last, all other leading sugar producing provinces recorded a decrease both in the area cultivated and the production of sugar. The three highest percentages of reduced area cultivated corresponded to Cebu, Iloilo, and Laguna. The crop in the Province of Occidental Negros again fell short this year 8 per cent and in Pampanga 4 per cent. In production, all provinces, too, registered corresponding decrease, except the Province of Pampanga, which had this year produced 23 per cent more than last season.

The production of muscovado sugar again decreased this year in favor of the centrifugal sugar. Of the total production of sugar obtained this year 3,711,430 piculs were centrifugal sugar and 2,735,370 piculs were muscovado sugar. Comparing these figures during the three years of 1922–23, 1921–22, and 1920–21, which were 57.6, 47.3, and 36.1 per cent respectively for refined and centrifugal sugar against 42.4, 56.3, and 63.9 per cent respectively for muscovado sugar, the influence of the cen-

trals on this industry becomes evident. During the year there were 33 centrals operating with a daily capacity of 22,870 tons of canes. Two small ones closed down at the close of the year.

Table III shows the area cultivated, the production of sugar, panochas, basi, and molasses, the average yield of sugars and panocha per hectare, the average prices value of this crop for 1903 and from 1910 to 1923.

TABLE III

Years	Area cultivated	Amount of sugar produced	Amount of panocha produced	Basi produced	Molasses produced
	Hectares	*Piculs*	*Piculs*	*Liters*	*Liters*
1903	71,885	3,849,286	.....	.....	17,844
1910	83,170	(a)	(a)	(a)	(a)
1911	120,310	(a)	(a)	(a)	(a)
1912	164,260	3,831,360	204,080	11,856,830	3,858,280
1913	178,120	4,606,910	342,520	8,987,650	2,301,450
1914	169,440	5,477,160	379,650	9,342,510	2,480,030
1915	173,090	5,694,490	346,660	5,544,150	2,339,090
1916	179,760	5,538,050	375,190	6,753,320	2,216,640
1917	185,930	5,728,670	370,920	7,016,840	1,969,600
1918	205,510	6,264,710	544,550	7,106,780	5,085,190
1919	200,200	5,994,100	508,230	8,716,980	2,038,710
1920	197,400	6,195,460	501,460	10,069,810	4,095,980
1921	241,340	8,065,950	388,340	8,039,590	7,524,740
1922	240,820	7,200,070	447,450	10,537,980	21,135,320
1923	227,290	6,446,800	370,780	7,531,230	9,876,230

Years	Average production of sugar and panocha per hectare	Average price of sugar per picul	Average price of panocha per picul	Average price of basi per 100 liters	Average price of molasses per 100 liters	Total value
	Piculs					
1903	53.54	(b)	(b)	(b)	(b)	(b)
1910	29.01	(b)	(b)	(b)	(b)	₱15,263,930
1911	32.05	(b)	(b)	(b)	(b)	24,392,460
1912	24.57	₱6.33	₱6.32	₱6.00	₱5.00	26,428,630
1913	28.10	5.06	5.06	6.00	5.00	25,698,450
1914	34.56	4.73	4.55	7.31	7.52	28,631,550
1915	34.90	5.41	5.13	7.81	8.74	35,212,480
1916	24.09	5.65	5.79	7.41	8.02	34,136,130
1917	32.81	6.20	6.51	8.59	8.23	38,704,710
1918	33.12	5.79	6.95	7.59	11.69	41,158,780
1919	32.47	11.41	9.45	12.03	10.99	74,462,820
1920	33.93	23.66	18.95	24.00	18.34	159,257,120
1921	35.03	11.01	11.96	20.97	16.98	96,378,980
1922	31.76	7.21	6.84	18.53	13.33	59,948,250
1923	30.00	12.74	8.00	19.65	12.60	87,831,550

[a] Not classified by products prior to 1912. [b] Not available.

COCONUTS

With over 2,000,000 more trees planted than last year, this promising product registered this year another bumper crop only exceeded by 2 per cent by that for 1920–21.

There were also a little over half a million new trees coming into bearing and the production of nuts per tree was 2 per cent larger than the year before.

The total number of tress planted June 30, 1923, was 86,707,380 against 84,536,710 June 30, 1922, or 3 per cent more. For the same periods, the number of bearing trees was 49,809,380 and 49,379,910 respectively, or 1 per cent larger, and the *tuba* trees were 1,028,520 and 803,000, respectively, or 28 per cent larger. During the year there were gathered 1,515,253,000 nuts against 1,467,684,000 the year before, or an increase of 3 per cent, at an average of 30.4 and 29.7 units per tree, respectively. Of the total number of nuts gathered practically 95 per cent were made into copra, of which there were 5,820,250 piculs, 4 per cent were consumed for food and 1 per cent used by the natives for making 2,578,770 liters of oil. From the *tuba* trees there were extracted this year 121,802,580 liters of *tuba* against 105,431,050 in 1921–22.

Of the total production of copra, 2,597,680 piculs was sun-dried, or 44.6 per cent; 3,220,170 piculs smoked, or 53.3 per cent and 2,400 piculs were steamed. This year there was a reduction of 2 per cent in the grade of sun-dried copra in favor of smoked copra as compared with the preceding year, due to the rainy weather that prevailed in 1922–23.

There was an increase also of 16 per cent in the total value of all coconut products, partly due to the higher prices obtained this year, that amounted to the aggregate sum of ₱64,365,220 against ₱55,267,680 last year. The increase was registered in the prices of nuts and copra which this year were quoted at ₱3.32 per 100 nuts and ₱8.93 per picul of copra, while a year ago only ₱2.99 and ₱7.60 respectively, were paid. On the contrary, the home-made oil fell this year to ₱.35 per liter from ₱.38 last year and the *tuba* commanded the same price as the year before, ₱.08 per liter.

Tayabas and Laguna are the leading provinces in the cultivation and production of coconuts in the Islands and in general the only places where the growers are considered satisfied for they do not have worries because of the scarcity of money and labor, a shortage of work animals or lack of easy means of communication. These two provinces have together 27,483,900 trees planted, or about one-third, or to be exact, 31.7 per cent of the total number in the Islands, and they produced this year 510,090,000 nuts mostly used for copra with a production of 2,005,490 piculs, or 33.7 and 34.4 per cent respectively of the total for the Philippines.

The following Table IV shows the progress of the coconut industry in these Islands since 1903:

TABLE IV

Years	Trees planted	Nuts gathered	Average production per tree
	Number	*Number*	*Nuts*
1903	(a)	232,315,000	(a)
1910	32,838,540	937,928,000	(a)
1911	41,695,160	965,186,000	(a)
1912	46,136,350	1,041,182,000	(a)
1913	44,642,410	781,585,000	(a)
1914	49,190,370	591,266,000	(a)
1915	52,529,650	865,816,000	30
1916	54,153,350	735,276,000	25
1917	60,244,050	880,589,000	28
1918	67,120,400	1,506,796,000	40
1919	74,120,400	1,454,951,000	34
1920	79,406,100	1,509,504,000	35
1921	83,591,900	1,547,583,000	33
1922	84,536,710	1,467,684,000	30
1923	86,707,380	1,515,253,000	30

[a] Not available.

Years	Nuts consumed for food	Copra produced	Oil produced	Tuba produced
	Number	*Piculs*	*Liters*	*Liters*
1903	(a)	677,230	1,671,090	11,388,070
1910	311,609,000	1,867,340	6,993,510	174,483,480
1911	154,981,000	1,870,720	6,602,970	37,649,880
1912	96,262,000	2,761,550	4,868,100	39,842,910
1913	147,981,000	1,845,060	5,010,540	42,146,870
1914	63,053,000	1,697,750	3,595,380	54,048,390
1915	72,441,000	2,712,630	3,175,630	51,372,210
1916	63,818,000	2,241,330	2,688,300	53,938,610
1917	64,586,000	2,948,790	2,623,690	43,674,590
1918	91,612,000	5,480,740	4,535,330	83,922,800
1919	75,359,000	5,523,870	5,142,210	100,315,520
1920	84,216,000	5,717,080	2,879,460	98,068,840
1921	83,556,000	5,922,880	2,706,720	103,854,740
1922	68,239,000	5,799,350	2,872,230	105,431,060
1923	57,656,000	6,820,250	2,576,770	121,802,680

Years	Average price of nuts per 100	Average price of copra per picul	Average price of oil per 100 liters	Average price of Tuba per 100 liters	Total value
1903	(a)	(a)	(a)	(a)	(a)
1910	₱2.07	₱6.55	₱20.71	₱3.45	₱26,161,630
1911	3.00	9.49	30.00	5.00	26,261,270
1912	3.00	10.75	30.00	5.00	35,526,540
1913	4.00	11.38	30.00	5.00	30,535,660
1914	4.00	10.23	34.08	6.51	24,651,760
1915	2.99	6.77	20.86	6.47	24,461,880
1916	3.41	8.48	26.53	4.68	24,430,960
1917	3.73	9.00	31.32	4.99	31,975,490
1918	3.63	8.44	29.66	4.64	56,683,790
1919	4.39	10.90	36.00	10.00	75,438,290
1920	6.70	18.78	59.00	14.00	128,196,890
1921	4.73	10.04	52.73	10.95	76,192,530
1922	2.99	7.60	37.87	7.67	55,267,680
1923	3.32	8.93	35.36	7.87	64,366,210

[a] Not available.

ABACA

This crop, the fiber par excellence in the world, which declined considerably in its production after the signing of the Armistice

because of a glutted market, was restored this year to its former rank the largest production ever known in the Islands having been recorded. During the decade prior to the signing of the Armistice, the annual production of abaca was 2,468,090 piculs and the largest crop known was that for 1911, which was 2,717,460 piculs. This year the production was 2,986,380 piculs, which was 21 per cent larger than the 10-year average of 1910–19, 10 per cent larger than the record crop for 1911 and twice as much last year crop.

This excellent result obtained by the farmers despite their difficulties in securing sufficient labor was realized because of the big demands this year for abaca fiber in the world markets and a proportional rise in the prices commanded, from ₱10.41 per picul last year to ₱13.16 this year. This price was ₱1.33 higher than that normally prevailing before the war, but the prices during the war ranging on the average from ₱25 to ₱35 per picul so intoxicated growers and labor, that the former are still expecting these abnormal prices and the latter not satisfied with the share allowed them in the production which before was ordinarily one-third and thereafter demanded as much as one-half and even two-thirds. The result was that in the three years 1920–21 to 1922–23 the loss in the area cultivated for the Philippines was 21 per cent in favor of other crops such as coconuts and palay. It is true, however, that in this loss there are included other losses from typhoons and plant pests, but comparatively speaking, it is believed that the proportion from these two latter causes is not so very great.

The prevalence of abaca diseases had also some share in this reduction of the area cultivated, and the provinces most affected thereby, so far as were reported, were Cavite and Laguna. These two provinces lost severely in several of its different towns. There are no data by which to gauge the loss from heart-rot and root-rot, but comparing the area actually planted with that existing June 30, 1920, both provinces lost from all causes 48 per cent but mainly due to these pests.

The total area planted to abaca June 30, 1923, was 513,421 hectares, or 4 per cent larger than last year which was 494,990 hectares.

The area productive was 344,240 hectares this year against 264,500 hectares last year, or an increase of 30 per cent. It is believed, however, that this increase was not all obtained during the year under discussion, but that there were more hectares productive last year that were not so reported because they were neglected for lack of an attractive price. The crop was valued

at ₱39,317,490 against ₱19,918,860 last year, or 97 per cent more.

In the following Table V there are given the area cultivated, production, average yield per hectare, average price per picul, and total value of abaca for 1903 and from 1910 to 1923:

TABLE V

Years	Area cultivated	Amount of abaca produced	Average production per hectare	Average price per picul	Total value
	Hectares	*Piculs*	*Piculs*		
1903	217,810	1,055,430	4.84	(a)	(a)
1910	475,140	2,663,270	5.61	₱10.12	₱26,952,340
1911	404,160	2,717,460	6.72	10.12	27,500,740
1912	432,800	2,521,320	5.82	11.38	28,705,210
1913	368,210	2,221,660	6.04	14.55	32,319,680
1914	437,470	2,176,060	6.83	13.77	29,968,010
1915	457,860	2,437,830	7.36	12.48	30,420,740
1916	448,660	2,415,120	7.27	17.71	42,767,340
1917	488,500	2,544,720	7.46	24.99	63,598,140
1918	512,510	2,686,160	7.67	36.06	92,493,220
1919	515,660	2,345,310	6.88	27.72	65,006,010
1920	559,360	2,609,980	7.21	24.16	63,068,850
1921	548,090	1,713,100	6.09	15.66	26,829,220
1922	494,990	1,913,770	7.23	10.41	19,918,860
1923	515,420	2,986,380	8.67	13.16	39,317,490

(a) Not available.

CORN

Corn is the chief food crop of the Islands after rice and maintains about 24 per cent of its population. When the rice crop fails for any reason, corn is planted as a substitute or for selling to buy rice, and therefore there was planted this year the largest area ever planted and the largest production known was gathered.

It is not that the rice crop was a failure, for on the whole it was the largest crop ever harvested, but the production decreased in some provinces and the farmers hastened to grow corn to offset a possible shortage of food and thus it happened that in most of the provinces where the rice crop failed, such as Albay, Antique, Batangas, Capiz, Cavite, Ilocos Sur, Laguna, Lanao, La Union, Marinduque, Masbate, and Surigao, there was registered a larger area planted to corn. This provident action was in part due to the timely warning given the farmers by the Bureau of Agriculture, through circulars sent out to the provincial governors, advising them to urge the planting of corn to offset the losses in the rice production from the typhoons and heavy rains.

The area cultivated this year was 557,690 hectares which yielded the record crop of 7,828,920 cavans, and as a consequence there was a fall in the price to ₱4.10 per cavan. Compared with the preceding year the corresponding figures are

549,960 hectares, 6,416,450 cavans at ₱4.50, or an increase of 1 per cent in the area, 22 per cent in the production, but a decrease of 9 per cent in the price per cavan.

The total value of this crop was ₱32,388,700 against ₱29,125,200 or 11 per cent increase over the last year.

Table VI below shows the area cultivated, production and average yield per hectare of corn for 1903 and the same data and the average price and the total value from 1910 to 1923.

TABLE VI

Years	Area cultivated	Production	Total value
	Hectares	*Cavans*	
1903	107,980	1,593,670	(*)
1910	288,270	2,467,570	₱8,661,180
1911	302,520	2,485,460	8,723,740
1912	340,200	3,666,200	12,868,360
1913	383,710	4,339,340	16,231,080
1914	421,510	6,266,150	15,873,800
1915	443,050	6,908,360	16,067,660
1916	432,770	6,616,940	14,723,960
1917	428,290	6,315,456	17,639,800
1918	418,390	5,295,700	21,018,650
1919	430,710	5,686,090	37,116,430
1920	537,130	7,372,100	50,910,870
1921	543,830	6,884,000	38,187,270
1922	549,960	6,416,450	29,125,200
1923	557,690	7,828,920	32,388,700

*Not available.

TOBACCO

Tobacco registered this year a reduced production due greatly to unfavorable weather. The crop is planted in the latter part of the year, but the season was too rainy because of typhoons that damaged the crop. The province worst hit was Isabela where there were several floods that washed away many seedbeds and plantations which could not be replanted for lack of seeds, so that both the area under cultivation and yield per hectare of tobacco were greatly reduced.

The crop of 1921–22 was the smallest on record, due to the low prices that prevailed to the discouragement of the growers who therefore did not plant their usual area. The 1922–23 crop is 8 per cent larger in the area planted and 10 per cent in the production than last year.

There were planted during the year 64,730 hectares against 59,870 last season which yielded 713,170 and 630,580 quintals respectively. In the yield per hectare there was also this year a slight increase—1 per cent over last year, or 11.02 quintals per hectare against 10.87 last season—because of improved weather conditions in some regions that followed the typhoons.

The prices did not advance sufficiently to become attractive to growers, but were higher than those before the war, when

they averaged ₱6.93 per quintal. During the five years of the war (1915–19) the average price was ₱10.57 per quintal. Last year was ₱9.55 against ₱9.25 the preceding season. The total crop was valued at ₱6,814,800 which was 13 per cent larger than the 1921–22 value, or ₱6,019,870.

The tobacco region in the Island of Luzon is made up of the Provinces of Isabela, Cagayan, Ilocos Norte, Ilocos Sur, La Union, Abra, Pangasinan, Mountain Province, and Nueva Ecija. With the exception of Isabela and Nueva Ecija which this year planted an area of 30 and 22 per cent, respectively, smaller than last year, all other provinces increased sufficiently to offset the losses of Isabela and Nueva Ecija and even exceed by 3 per cent the aggregate area planted this year as compared with that of last year; but this year these provinces planted only 71 per cent of the total tobacco area of the Islands, while last year they planted 75 per cent. The Visayan tobacco region includes the Provinces of Iloilo, Cebu, and both Occidental and Oriental Negros and all together planted 51 per cent more land this year than the past season and planted 20 per cent of the Philippines tobacco land cultivated this year or 6 per cent more than the year before which was only 14.

The following table gives the area planted, production and average yield per hectare for 1903, and the same data and average price per quintal and value from 1910 to 1923.

TABLE VII

Years	Area cultivated	Amount of leaf of tobaco produced	Average production per hectare	Average price per quintal	Total value
	Hectares	*Quintals*	*Quintals*		
1903	31,417	369,770	11.77	(*)	(*)
1910	53,630	608,840	11.35	₱6.90	₱4,201,020
1911	69,020	554,740	8.04	6.90	3,827,720
1912	57,040	643,110	11.27	6.90	4,437,470
1913	68,990	1,001,310	14.51	6.90	6,909,060
1914	60,899	1,015,900	16.68	7.00	7,109,370
1915	53,340	832,670	15.61	6.83	5,684,580
1916	58,910	894,330	13.18	8.12	7,259,170
1917	61,780	1,063,670	17.22	10.23	10,883,520
1918	78,440	1,338,160	17.06	11.37	15,219,180
1919	73,860	1,228,210	16.63	14.32	17,585,450
1920	101,120	1,410,730	13.95	18.97	26,765,950
1921	90,980	1,147,800	12.62	7.65	8,777,570
1922	59,870	650,580	10.87	9.25	6,019,870
1923	64,730	713,170	11.02	9.55	6,814,800

(*) Not available.

MAGUEY

This fiber, like abaca, registered this year the largest production ever known, due to the same reason, *i. e.* a great demand in foreign markets.

The total area planted June 30, 1923, was 28,570 hectares, of which 78 per cent or 22,200 hectares were productive against 27,670 hectares or 69 per cent or 19,170 hectares the year before. The production increased from 268,700 piculs last year to 427,400 piculs this year or 59 per cent and the total value also increased from ₱1,694,470 last season to ₱3,018,770 this season.

The leading provinces in the production of maguey are Cebu, Ilocos Sur, Ilocos Norte, Bohol, and Pangasinan, which together have this year 94 per cent of the total area cultivated, the same as they had last.

Table VIII shows the area cultivated, production, average yield per hectare, average price per picul and total value of maguey since 1912.

TABLE VIII

Years	Area cultivated	Amount of maguey produced	Average production per hectare	Average price per picul	Total value
	Hectares	*Piculs*	*Piculs*		
1912	8,600	73,170	8.51	₱7.59	₱555,400
1913	9,280	57,230	6.17	8.22	470,600
1914	18,220	119,900	11.65	7.18	860,760
1915	19,220	99,850	8.05	6.24	622,590
1916	30,800	211,690	8.98	8.25	1,747,260
1917	28,100	271,780	12.31	12.38	3,363,380
1918	32,600	263,470	11.99	14.07	3,707,210
1919	28,460	194,760	10.83	9.86	1,919,750
1920	30,570	287,400	14.17	11.86	3,407,960
1921	30,380	145,100	8.78	7.27	1,054,260
1922	27,670	268,700	14.02	6.31	1,694,470
1923	28,570	427,400	19.25	7.06	3,018,770

SWEET POTATOES

During the year reviewed there was registered an increase of 8 per cent in the area planted to this root crop as compared with the preceding year and also a slight increase, .5 per cent, in the production, but on account of unfavorable weather the average yield per hectare fell short by nearly 2 per cent.

The total area planted this year was 80,350 hectares and the production was 188,482,800 kilos against 74,580 hectares and 187,570,000 kilos, respectively, last year. The average yield per hectare for the same years was 2,346 and 2,515 kilos, and the total value, ₱3,751,100 and ₱3,742,600, respectively.

In the order of their importance, Samar, Leyte, Cebu, Albay, and the Mountain Province lead in the production of sweet potatoes, with a total of 93,035,300 kilos or 49 per cent of the total crop of the Islands. The weather was not favorable this year, however, so this production was 3 per cent smaller than last year, although the area planted was 11 per cent larger.

Table IX shows the area cultivated, production, average yield per hectare, average price per kilo and the total value of sweet potatoes for 1903 and from 1920 to 1923.

TABLE IX

Years	Area cultivated	Production	Yield per hectare	Average price per kilo	Total value
	Hectares	*Kilos*	*Kilos*		
1903	23,870	65,542,700	2,745	(a)	(a)
1920	63,390	142,464,000	2,248	₱.03	3,638,400
1921	63,560	191,022,000	3,005	.02	3,240,800
1922	74,580	187,570,000	2,515	.02	3,742,600
1923	80,350	188,482,800	2,346	.02	3,751,100

(a) Not available.

CACAO AND COFFEE

Of these two crops the former registered a slight increase, 0.66 per cent, during the year and the latter because of typhoons, a slight decrease, 1 per cent, in the number of trees under cultivation. There were last year, 1921–22, 1,912,700 cacao trees and 2,205,300 coffee trees against 1,925,400 and 2,184,500, respectively, this year.

Because of heavy rains and strong winds which destroyed the flowers the yields per tree for both products decreased also this year, and therefore the production of cacao was 4.95 per cent smaller than last year. As to coffee, however, new trees coming into bearing offset the loss and the production this year was a fraction of 1 per cent larger than last, the respective production being 1,045,400 kilos of cacao and 1,155,700 kilos of coffee against 1,078,200 and 1,148,900 kilos.

The cacao was sold for ₱1,145,500 and the coffee for ₱767,300 against ₱1,244,400 and ₱822,800 respectively last year.

The following table shows the number of trees cultivated, the production and the value of cacao and coffee for 1903 and from 1914 to 1923.

TABLE X

CACAO

Years	Trees cultivated	Production	Total value
		Kilos	
1903	(a)	689,200	(a)
1914	1,868,900	565,800	₱354,000
1915	1,869,700	625,600	399,000
1916	1,719,500	658,300	345,000
1917	1,618,000	537,300	338,500
1918	1,827,900	566,200	520,700
1919	1,853,200	572,700	536,000
1920	1,871,700	823,500	924,700
1921	1,656,200	888,900	1,267,700
1922 b	1,912,700	1,078,200	1,244,400
1923	1,926,400	1,045,400	1,145,500

TABLE X—Continued

COFFEE

1903	[a]	72,440	[a]
1914	1,970,000	626,400	302,800
1915	2,098,200	694,900	342,100
1916	2,111,000	752,200	361,700
1917	1,650,300	594,600	281,600
1918	1,920,600	721,500	446,000
1919	1,931,600	717,200	514,300
1920	2,015,200	998,800	823,800
1921	2,096,500	1,062,300	1,054,400
1922	2,205,300	1,148,900	822,800
1923	2,184,500	1,155,700	787,300

[a] Not available
[b] Revised.

LIVESTOCK

As usual the figures for animals presented herein are one year late, that is they are as of December 31, 1922. This inevitable delay is due to the utter impossibility of completing the compilation of the schedules for December 31, 1923, in the short time between that date and that fixed for presenting this report. Furthermore, due to many losses of reports and schedules in the mails, probably because of unfavorable weather conditions, and the distance away of many of the towns reporting and the long time between mails, the compilation of figures for 1922 was greatly handicapped, so the figures given herein for carabaos, cattle and horses and mules are subject to changes in a later issue.

During the year 1922, all animals registered increases in the number of head, and so, too, the rate of increase for the year rose for carabaos, horses, goats, and sheep, but those for cattle and hogs, fell off about 5 per cent for the former and 6 per cent for the latter, due to a fall of 6 and 4 per cent respectively in the rates of birth as compared with the preceding year. The rates of birth for carabaos and horses also fell off 4 and 7 per cent, respectively, while goats and sheep rose 5 and 2 per cent, respectively.

Conditions as to animal diseases improved during the year slightly however, for carabaos, goats, and sheep, but remained the same or were worse by fractions of 1 per cent as to the other animals.

Meat consumption was about the same this year as the year before as to cattle but as to hogs decreased by about 1½ per cent.

The following table shows the number of head of the six principal kinds of animals from 1910 to 1922, the figures for the last year named as to carabaos, cattle and horses and mules being subject to changes as stated before:

TABLE XI

Years	Carabaos	Cattle	Horses	Hogs	Goats	Sheep
1910	705,800	243,200	138,200	1,637,800	422,200	88,800
1911	809,300	289,800	146,600	1,661,800	441,300	92,600
1912	911,500	337,200	162,400	1,735,000	476,600	97,600
1913	1,047,200	418,100	179,100	2,016,700	529,200	104,100
1914	1,147,400	477,700	215,800	2,285,900	592,000	118,000
1915	1,222,000	534,100	223,200	2,521,100	644,600	129,500
1916	1,228,800	567,500	203,400	2,734,800	661,900	142,100
1917	1,271,200	603,100	214,200	2,810,700	722,500	155,800
1918	1,338,100	601,300	234,000	2,894,400	741,100	165,700
1919	1,338,200	678,500	255,400	3,129,700	731,800	168,200
1920	1,464,300	760,900	269,000	3,639,200	821,700	195,700
1921	1,535,900	806,200	279,300	4,477,000	891,800	223,300
1922	1,541,100	815,800	294,200	5,241,200	1,012,600	257,700

THE OUTCRY OF THE FARMERS

During the year the Division of Farm Statistics made inquiries as to the handicaps encountered by farmers. Most of these have already been mentioned, but the most important and common to all is the lack of credit and means of communication and transportation.

The lack of a clear title to his lands, shuts the bank to the small farmer, and the present Rural Credit Associations are too few and poor to meet the needs of all. Many suggestions have been made to the effect that these associations be capitalized by the Government from funds of the National Bank, thereby extending to small farmers the benefits thereof, and that their actual land titles in the absence of the Torren's title be considered enough for the purpose of getting credit. Indeed, the condition of these small farmers—usually palay growers—is most precarious and most of them have to assume onerous obligations to produce the food needed by the country.

Granted that good prices are the best inducements for farmers to produce more, but even when good prices are paid the small farmers do not share them, for they have to pay a very high rate of interest on the money loaned to them with the result that they are unable to pay off their debts completely. Because also of their lack of capital or credit, they can not start the new planting of their lands without first disposing of their produce and so are forced to sacrifice it.

Another means suggested to finance these small farmers is the establishment of bonded bodegas or warehouses where they can deposit their produce and get credit thereon.

The lack of means of communications and transportation as before said is another serious check to the natural development

of agriculture. The actual roads in many regions are converted during the rainy season into lakes of mud through which the crops are transported under the greatest difficulties and with the result that the crops deteriorate or spoil so that they lose both in quantity and quality. In many regions there are available vast areas of land that could be easily cultivated, but those places are segregated because of the lack of good roads and the farmers therein grow only what the local or home, market demands, while other places as Manila, have to import from abroad for lack of supply.

The construction of dams or dikes along certain parts of the Agno River in Pangasinan is becoming more and more imperative. Every year this river overflows and floods thousands of hectares of land as far up as Tarlac Province and causes serious damage to the farmers, who are forced to undergo in most instances additional expense as they have to replant the areas destroyed by the floods or else let it lie follow.

A law should be enacted compelling all owners of land to keep irrigation canals crossing their lands clean. It is claimed that during the Spanish administration there were appointed "capitanes de riego" whose duty it was to inspect all the canals and that they had authority to compel their cleaning. Since then, these canals have been neglected and the water does not flow freely, and therefore other farms are prevented from receiving all the water necessary.

A law should also be enacted strictly prohibiting owners for leaving animals at large. This custom is most prejudicial to the growers, for their plantations with or without fences are destroyed by domestic animals as carabaos, cattle, pigs, etc. The municipal ordinances in force in certain towns have proved to be inadequate.

The anual heavy rains and floods reduce the area of lands planted to rice, corn, and other crops for lack of seeds to replant the portions destroyed. It has been suggested that the Bureau of Agriculture should have a permanent fund for supplying seeds to the needy farmers payable at harvest or in easy installments.

One of the chief handicaps for the successful development of the livestock industry is the lack of adequate and sufficient pastures. It has been suggested that the opening of "communal pastures" in each municipality would greatly aid the owners.

It has also been suggested that the Public Utility Commission should regulate the freight of animals to be collected by shipping companies. It is claimed that actually the rates of freight are the same whether the animals are of first, second, or third class, but the owners are paid for their animals according to kind.

GENERAL ADMINISTRATION

PERSONNEL

During the year, the position of Assistant Director was not filled. Mr. Ludovico Hidrosollo, acting chief of the Agricultural Extension Division transferred to the Bureau of Non-Christian Tribes and his duties were taken over by Mr. Jose Camus. Mr. Mariano Medalla, assistant plant pathologist resigned sometime during the year.

The following table shows the number of personnel both classified and unclassified, of the Bureau and the changes during the year:

Changes	Americans		Filipinos		Total
	Permanent	Temporary	Permanent	Temporary	
Appointed	0	2	37	423	462
Promoted	0	0	31	4	35
Separated	0	2	41	99	142

Non-Christian personnel.—Non-Christian laborers are employed by this Bureau in its Tobacco Station at Pikit, Cotabato. The practice of employing these people has been followed since 1920 when that station was established. Though they are in most cases not educated, they are according to the superintendent of that station, skillful and constant. The positions left by the old are usually taken over by their young relatives. The daily wages range from 50 to 80 centavos for the men and from 40 to 60 centavos for the women laborers.

Since the establishment of the Bontoc Semi-Temperate Fruit Sub-Station in the Moutain Province, non-Christian laborers have also been employed in said station. The superintendent of this station states that "they are hard-working, painstaking, peaceful, obedient and easy to handle."

TABLE XII.—*Comparative statement of expenses and income of the Bureau of Agriculture during the years 1922 and 1923*

Items	Year 1922	Year 1923	Increase + Decrease —
EXPENDITURES			
Salaries	₱708,187.38	₱646,863.61	— ₱61,323.72
Wages	156,423.06	145,559.74	— 10,863.32
Traveling expenses of personnel	179,870.50	157,453.86	— 22,416.64
Freight, express, and delivery service	12,018.79	7,974.08	— 4,044.71
Postal, telegraph, telephone, and cable service	19,824.78	16,217.55	— 3,607.23
Illumination and power service	5,332.26	5,227.31	— 104.95
Miscellaneous service	3,248.60	1,987.92	— 1,260.68
Rental of buildings and grounds	8,334.96	4,278.52	— 4,056.44
Consumption of supplies and materials	136,549.18	116,239.79	— 20,309.39
Printing and binding reports, documents and publications	25,655.20	19,184.25	— 6,470.95
Contributions and gratuities	55,467.57	99,956.08	+ 44,488.51
Maintenance and repair	9,322.32	9,980.08	+ 657.76
Outlays (furniture and equipment)	4,523.40	7,561.64	+ 3,038.24
Deterioration of supplies and sales stock	37,685.62	2,178.70	— 35,406.92
Extraordinary losses	10,906.94	3,791.43	— 7,115.51
Additional fund as per Resolution No. 26 of the Emergency Board	87,168.86	.....	— 87,168.86
Additional fund, Act 3119 (eradication of anthrax)	.....	9,465.72	+ 9,465.72
Total expenditures	1,460,419.37	1,253,920.28	— 206,499.09
INCOME			
Income from rentals	6,599.75	9,655.07	+ 3,055.52
Service income	186,294.53	221,390.99	+ 35,096.46
Miscellaneous receipts	91,645.03	99,080.67	+ 7,435.64
Total income	284,539.31	330,126.73	+ 45,587.42
NET COST	1,175,880.06	923,793.55	+ 252,086.51

TABLE XIII.—*Operation statement, special appropriations, during the years 1922 and 1923*

Items	Year 1922	Year 1923	Increase + Decrease —
EXPENDITURES			
Mutual insurance to work animals, Acts 2764 and 2903	₱49,502.78	₱7,999.67	— ₱41,503.11
Mutual insurance to work animals, Acts 2764 and 2903	116.50	3,942.90	+ 3,826.40
Total expenditures	49,619.28	11,942.57	— 37,676.71
INCOME			
Mutual insurance to work animals, Acts 2764 and 2903 (premium)	30,238.11	794.40	— 29,443.71
Mutual insurance to work animals, Acts 2764 and 2903 (membership fees)	1,046.50	62.00	— 984.50
Total income	31,284.61	856.40	— 30,428.21
NET COST	18,334.67	11,086.17	— 7,248.50

ADMINISTRATIVE DIVISION

PERSONNEL

At the beginning of the year there were 36 permanent and 29 temporary employees. These employees were distributed among the general service, records stenographic, collecting and disburs-

ing, and land transportation section. With this limited personnel during the year every possible effort was made to keep the work of this division efficient and up to date.

There was no important change in the personnel during the year. The position of Assistant Director was not filled during the fiscal year 1923 and necessarily the work incumbent upon this position was partly shifted to this division.

CORRESPONDENCE

During the year there were 187,149 pieces of correspondence handled of which 135,624 were letters sent and 51,524 were letters received as against 175,730 of the previous years or an increase of 6.5 per cent.

This is due to the fact that during this year we received more letters from private parties than in any previous years. The number of foreign letters, however, decreased considerably. The anthrax outbreak in Central Luzon contributed much toward the increase of correspondence handled during the year.

There were 1,662 telegrams sent, 979 registered mail received, and 762 registered mail sent. The number of telegrams received was not recorded. The messengers delivered 9,397 pieces of correspondence to different bureaus and offices in the city.

TRANSPORTATION

The Land Transportation Office is directly responsible for the operation of the 2 White trucks, 1 Dodge automobile, 1 farm wagon, 7 carromatas, and 4 carretelas of the Bureau of Agriculture. It furnished the necessary transportation for the Central Office of the Bureau which, because of the nature of its work, needs adequate transportation.

RECOMMENDATION

In order to fully comply with the call of the various divisions of the Bureau for official transportation the acquisition of additional horses is imperative.

From time to time later several motorcycles were sent for repairs so that at one time there were about ten machines in all in Bilibid. In spite of our urgent need for motorcycles for our locust campaign these machines were not ready until *August, September*, and *October*. The great consequent inconvenience and delay experienced by the Bureau would have been eliminated if we had only had in the service even one mechanic to attend to these repairs.

It is therefore recommended that six more native ponies be acquired this year for carromata transportation; and that ar-

rangements be made with the authorities concerned to allow this Bureau to have in its service two or three experienced mechanics to repair our motorcycles.

ACCOUNTING AND PROPERTY DIVISION

On January 1, 1923, the Accounting Division and the Property Division were combined into one division named the Accounting and Property Division. By this combination there were 8 employees dropped, leaving only 23 permanent employees, 2 chauffeurs and 8 laborers at the beginning of the year 1923. The chief of the then Accounting Division was appointed chief of the Accounting and Property Division while the chief of the Property Division was made assistant chief of the division. The assistant chief of the Accounting Division and the assistant chief of the Property Division were appointed chiefs of the bookkeeping section and auditing section, respectively.

The division is now divided into two big sections. Its principal work is auditing, classifying and paying all accounts including the salaries and traveling expenses of the field force; recording income, expenses, equipments and all sorts of assets and liabilities as classified by the Insular Auditor and by the Bureau; recording expenses and income of each of the different stations and its activities, 184 in number; collecting accounts in favor of the Bureau; preparing monthly trial balances and 10-day reports of expenses and income; preparing monthly statement of expenditures; acquiring by purchase or otherwise all kinds of property, equipments, supplies, and materials needed by the Bureau and issuing same to the personnel; ordering the repairs of all equipments and furniture of the Bureau; receiving and dispatching all kinds of shipments; and preparing the annual inventory of all Bureau property for submission to the Insular Auditor. The assistant chief of the division is also designated as acting superintendent of the Land Transportation Office.

Although the agricultural colony section with its personnel which existed in 1922 was suppressed in 1923 much information connected with the colony had to be gathered, recorded and disseminated.

The employment of additional forces for locust and rinderpest campaigns and then for the control of the anthrax have greatly increased the work of the division.

ANIMAL HUSBANDRY DIVISION

The Animal Husbandry Division this year has confined its efforts as best as possible in following the outline mentioned

in the four-year program submitted to the Honorable, the Secretary of Agriculture and Natural Resources on October 3, 1922. This work has been classified, namely:

1. Selection and distribution of live stock.
2. Establishment of stock farms, insular, provincial, and municipal.
3. Purchase and sale of animals for breeding for work and for meat purposes.
4. Establishment of poultry-swine stations in the provinces in cooperation with the Bureau of Education.
5. Feeds and feeding and breeding experiments.

To carry on this work only ₱80,675.41 was set aside but this as compared with previous years was entirely too small.

To avoid any overdraft it became imperative to reduce this year the number of technical men and laborers carrying the work of the division and consequently had to close several small breeding station.

The selection and distribution of live stock were followed as heretofore done by loaning good breeding animals or selling them to the public. The breeding animals of the Bureau are found distributed in different parts of the Archipelago at stock farms, public breeding stations, farm schools and other Government institutions. There are some animals too, that are directly under the care of private parties.

At the stock farms the main object is to raise horses, cattle, carabaos, sheep, goats, swine, and poultry for distribution to all parts of the Islands. At the breeding stations the main object is public-breeding service although a few stock is also raised to supply the local demand. Pigs and chickens are loaned to farm schools to enable the pupils to study and learn how to care for and raise them. The principal of the school is directly responsible to the Bureau of Agriculture for the stock loaned as well as for rendering the reports required by the latter.

The animals loaned to private parties are on the majority of cases bulls. These animals are loaned under the responsibility of the agricultural extension agents employed in some provinces by the Bureau of Agriculture and also through the provincial and municipal treasurers. The party borrowing guarantees the safe-keeping of the animal loaned. The limit for keeping animal is short—usually a year at which time it is transferred to another interested party under similar conditions.

Stallions and hogs are being loaned to penal colonies under the Bureau of Prisons. The purpose is to encourage the colonists to raise horses and pigs as well as to improve the native stock in those colonies.

The stock produced at the stations are largely sold for breeding purposes and also work and meat purposes, the latter are those animals unfit for breeding. The people in general are fast becoming interested in better stock as shown by the increased demand for same.

This division was not able to purchase new breeding stallions which were badly needed at our stations to replace those that had died or were no longer fit for breeding. The amount of ₱2,400, however, was made available by the Emergency Board as per Resolution No. 79 dated September 7, 1923 (Requisition No. 6577) for the purchase of poultry from the United States.

Through an arrangement with the Bureau of Education this division has been able to make up for the loss of some of its breeding stations and the non-establishment of new ones. It has supplied this year 31 farm schools with 63 pigs and 157 chickens and the results obtained average good.

The Iwahig Penal Colony, the College of Agriculture and the Provinces of Oriental Negros and Pangasinan are also cooperating with the Bureau of Agriculture in the public breeding work and the production of breeding animals for local demand.

Due to the very limited funds, this division had to limit itself to a few experiments. The experiments conducted are comparative egg production between Indian Runner and native ducks, cross breeding of these with the native and Pekin ducks and the feeding of adlay to chicks. The cross-breeding experiments that have been conducted on poultry since 1921 were continued this year.

Status of personnel during 1923

	Number of employees					
	Technical		Clerks	Foremen		Total
	Permanent	Temporary	Permanent	Permanent	Temporary	
Employees at the beginning of the year	3	8	2	1	4	18
New appointees during the year	.....	.....	.....	.....	1	1
Transferred from other Division	.....	.....	.....	.....	.....	.....
Separation during the year	.....	1	.....	.....	.....	1
Resignations during the year	.....	1	.....	.....	1	2
Transferred to other Divisions	.....	.....	.....	.....	.....	.....
Employees at the end of the year	4	5	2	1	4	16
Decrease of personnel	.....	.....	.....	.....	.....	2
Messenger	.....	.....	.....	.....	.....	.....

ALABANG STOCK FARM

The major work of this station at present has been the experimenting on feeds and feeding adaptable to Philippine conditions and the cross breeding of pure bred stock with already

well acclimated stock that do not posses the desirable characteristics of the pure breds. The most interesting of these is a cross of an Ayrshire bull with Nellore cows that have produced up to the present writing nine (9) healthy good looking calves ranging from one year to fifteen days old. Another experiment that will prove interesting to the Filipino poultrymen is that concerning the egg capacity of the native ducks as compared with the Indian Runner ducks, an imported breed which is considered in the United States as an egg-laying breed. The description of these experiments will be found elsewhere in this report.

Aside from the experimental work and the production of live stock there is also conducted some public-breeding service largely with boars and stallions. However, with respect to the stallions there is and there has been for some years a great need of renewing the old stock on hand that has been reduced to a very small number that cannot meet the present needs.

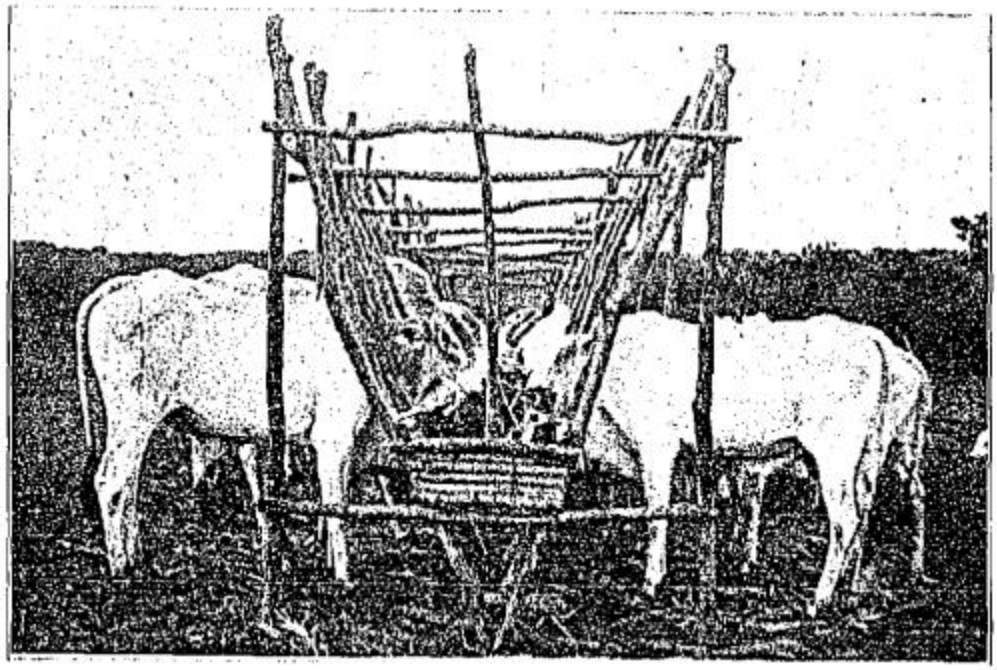
The income of the farm from sales alone amounted to ₱8,166.22. The approximate value of the animals raised to maturity for the farm's use is ₱8,321 and the value of the animals this farm transferred to other stations totalled ₱5,566, the aggregate sum of which credit the farm with ₱22,053.22. In this estimate is not included young stock that is ready for sale.

LA CARLOTA EXPERIMENT STATION

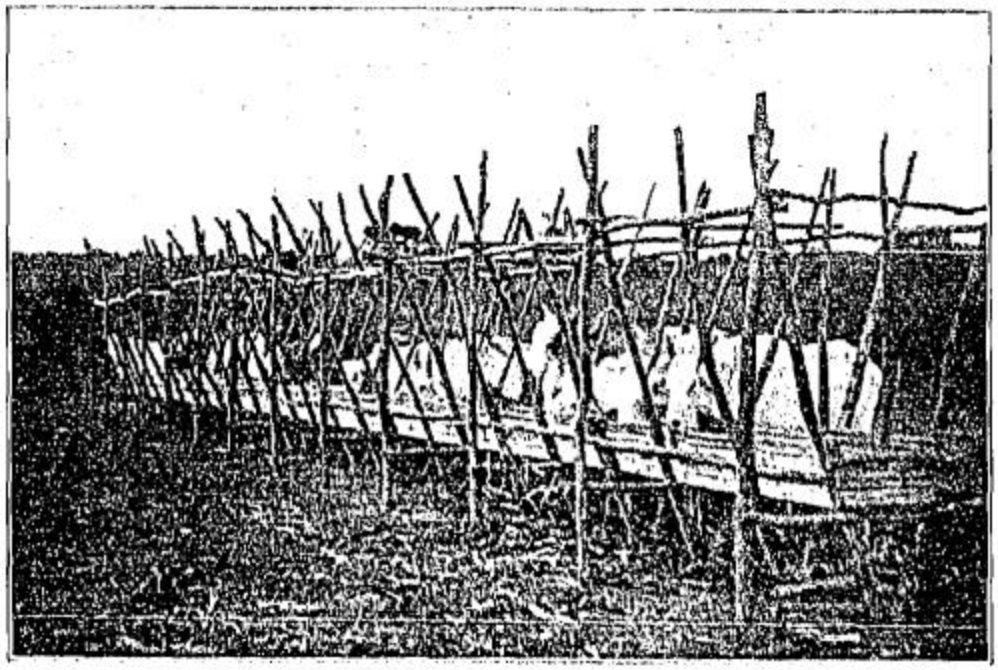
The most important work of this farm is cattle raising although there are a few sheep, goats, swine and poultry that help to increase the revenue of the farm and the interest of the people for the farm. There are at present 106 head of Indian cattle and 196 head of grade cattle. This herd supplies Occidental Negros and the nearby provinces with breeding animals and it is believed that mestizo animals can now be found all over the province. The grade bullocks find favor among the sugar planters as it is considered bigger and stronger than the native bullocks and more resistant to heat than the carabaos. The income of this station from sales alone totals ₱6,034.15. The estimated value of animals raised to maturity (this does not include animals born during the year which totals 147) is ₱3,200. The value of the animals transferred for public-breeding purposes is estimated at ₱300 which will credit this station with ₱9,523.55.

CEBU BREEDING STATION

The public breeding of horses and pigs is carried out by this station for the benefit of the Cebuanos and those of the neigh-



(a) A cheap feed-rack for cattle. Alabang Stock Farm



(b) Another view of the above

boring provinces. Pigs and several breeds of chickens are raised to supply local demand. This year the public-breeding work has not been so satisfactory as in previous years, especially that with horses due to the fact that the station does not have enough stallions. Two of the three stallions had to be transferred to the Dumaguete Breeding Station. Furthermore, the municipalities that used to maintain the public-breeding animals of this Bureau were unable to provide funds for maintenance this year due to money crisis so the animals were returned to the Bureau

There is a big demand for chickens. The people always ask for good breeding chickens from this station to improve their stock.

BATANGAS BREEDING STATION

The Batangas Province used to have three stallions; one at Batangas, one at Lipa, and one at Balayan. Of these only the first was maintained last year, the other two were closed due to shortage of funds and shortage of breeding stallions. The breeding of horses, cattle, pigs, and goats, comprises the most important work at this station although poultry is also raised to supply local demand.

ORIENTAL NEGROS BREEDING STATION

This station has two substations which are located in Guihulñgan and Zamboanguita. The central station is in Dumaguete. Poultry is raised in Dumaguete to supply the local demand. The people around Dumaguete are getting very fond of chicken raising and many of them visit the station to buy eggs and chickens. In fact several parties have already established small poultry farms in the province.

All the Bureau public-breeding sires have done satisfactory service during the year in this station.

With the exception of the superintendent's salary, the station's expenses are paid by the province; whatever income had goes to the provincial treasury.

BAYOMBONG CATTLE BREEDING STATION

This station raises Indian cattle primarily to promote the cattle industry in Nueva Vizcaya and adjoining provinces. A number of bulls have already been loaned to different cattle owners to improve their herds. The cattle men are very enthusiastic over this line of work as they find it greatly benefits them. With the opening of the provincial road connecting

Manila to this province, the cattle industry in that region will receive more attention from the cattle men.

PANDACAN CHICKEN HOUSE

This station has been kept by this division primarily for the purpose of quarantining imported stock that is suspected sick of any contagious disease. However, as importations are seldom made and the stock are rarely sick, this place would have to be closed and for this reason when not otherwise used, it serves as a public-breeding station for pigs and horses and also as a station to keep animals temporarily while awaiting shipment.

At present it raises also some Rhode Island Red and Cantonese cross that are under direct observation of this Office.

PUBLIC BREEDING

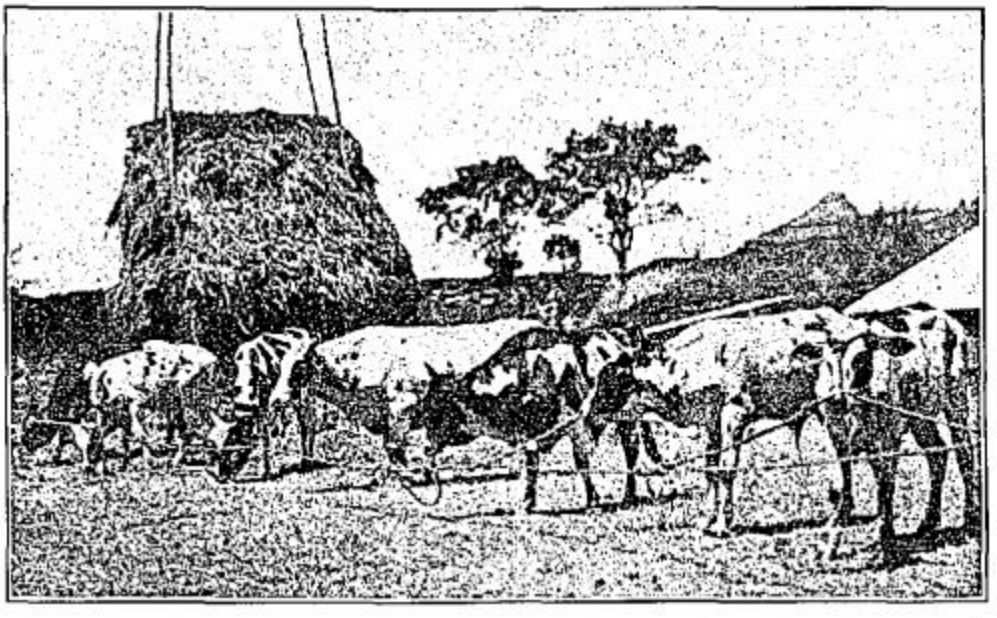
In order to give an idea of the public-breeding work done by the Bureau of Agriculture this year, reference should be made of the summary of the breeding records appended herewith. It will be noted that the public-breeding sires are distributed at different places in 25 provinces and that they rendered 1,932 services and had 2,729 offspring as follows:

	Services	Offsprings
Boars	960	2,219
Stallions	519	122
Bulls	331	292
Rams	55	47
Billies	67	49

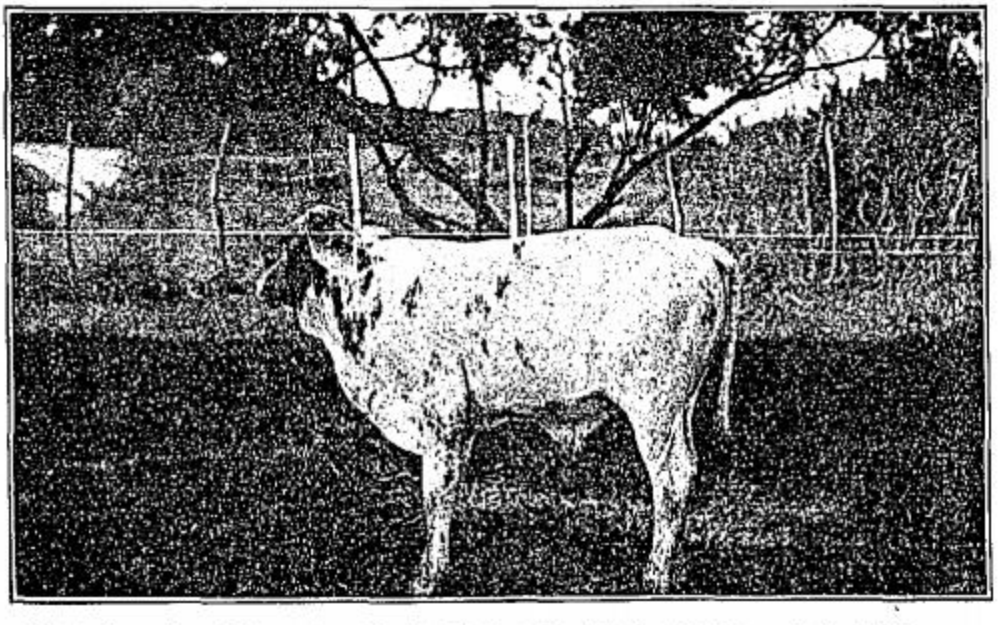
Estimating the increased value of the offspring at ₱50 for colts, ₱50 for calves, ₱10 for pigs and ₱2 for kids and lambs, it will be seen that at least ₱40,450 worth for improvement has been given by the Government to the public throughout the Islands.

As compared to previous years, it will be noted from the table below that there has been a decrease in the total number of offsprings. This decrease is due to causes already discussed in previous part of this report.

Year	Number of sires	Number of services	Number of offspring
1921	99	2,358	3,014
1922	90	1,433	2,932
1923	97	1,932	2,729



(a) At the center ayrshire bull with his offspring, 4 males and 2 females



(b) A close view of the male calf sired by Ayrshire bull No. 1418 from Indian Nellore cow No. 133

POULTRY-SWINE AND COÖPERATIVE STATIONS

The poultry-swine stations were established in connection with the food production campaign, a movement to encourage the production of more food stuffs and secondarily to raise the quality of produce through the introduction of high-grade animals mostly imported from foreign countries, such as cattle, horses, swine and poultry. The year 1923 started with 19 cooperative stations under the Bureau of Education and 2 under this Bureau which were geographically distributed as follows: 14 in Luzon; 4 in the Visayan region and 3 in Mindanao. The rapid growth of the number of these stations bids fair to the improvement in animal raising in this country. The sending of more animals to Mindanao for the improvement of the stock in this part of the Archipelago has further expanded our activities on animal raising.

The total number of animals in these stations were as follows: 21 boars and 31 sows representing the Berk-shires, Duroc-Jersey, Poland Chinas and Berkshire-Poland Chinas; and, 69 cocks and 146 hens of the Cantonese, Shanghai Red, Rhode Island Red, White Leghorn, Buff Orpington and Buff Orpington-Cantonese breeds.

The results obtained from the breeding animals were incalculable judging from the interest therein of the people inhabiting the places where the animals were sent. The people in the neighborhood even requested the Bureau of Education officials to buy these animals from the Bureau and the latter has gladly acceded and quoted them at their book values. As a result, three of the coöperative stations bought the animals loaned by the Bureau.

Economically speaking, these stations (coöperative) do not spend nor invest capital except labor as nearly all of them raise the feeds they give to the animals while whatever returns they may get from them will be theirs. Besides this advantage the students become familiar with the animals by actually handling them and through the instruction and supervision of their teachers they appreciate animal raising.

FEEDS AND FEEDING

The mixed feed forms the principal feed given to the animals in the station. This is given mostly to horses, pigs, and poultry.

The mixed feed consists of tiquitiqui, corn meal, mongo meal, and copra meal in proper proportion.

The quantity of mixed feed purchased during the year is 325,001.9 kilos, distributed to the following stations:

	Kilos
Alabang Stock Farm	250,570.3
La Carlota Experiment Station	8,176.0
Cebu Breeding Station	24,173.0
Batangas Breeding Station	3,560.0
San Antonio Poultry-Swine Station	3,000.0
Singalong	13,500.0
Pandacan (Chicken house)	6,749.0
Pandacan (Laboratory)	13,500.0
Iloilo (La Paz)	1,793.0
Jalajala	50.0

Forage crops such as Guinea grass, Japanese cane, Napier and Para grasses, corn and sorghum, are raised at these stations as supplementary feeds to the animals. Camotes, cassava, and legumes are also raised for feed. Papaya and banana trunks are also given to the animals as roughage.

The total quantity of feed produced at the stations are:

Kind of feed	Quantity	Value
	Kilos	
Palay	4,174	₱345.92
Corn	8,201	887.71
Sorghum	5,852	295.02
Cassava	7,855	429.22
Other forage	148,211	1,988.40
Charcoal	*36	71.60
Total		4,029.77

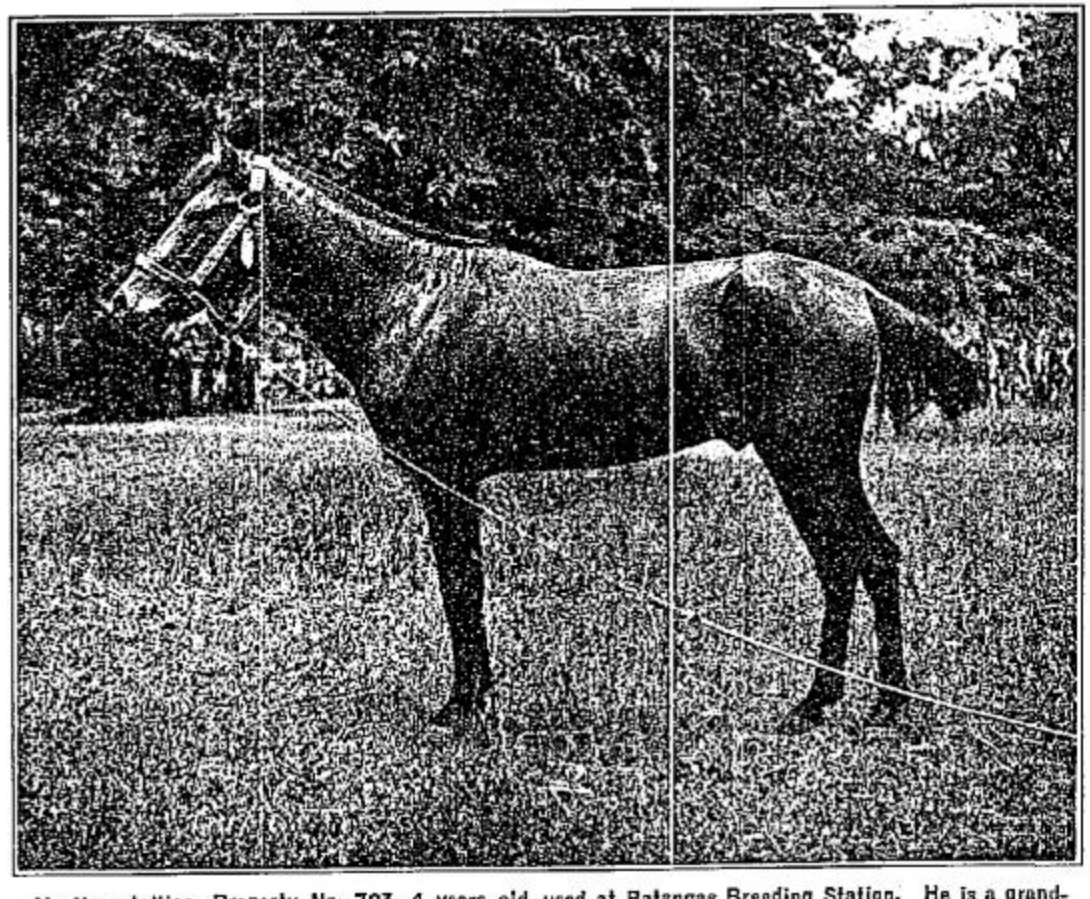
* Sacks.

During this year rinderpest and surra broke out in places near Alabang Stock Farm and later in the year anthrax prevailed in the Provinces of Rizal, Bulacan, Pampanga, and Nueva Ecija which caused a heavy toll upon cattle and carabaos but fortunately it did not enter the farm. Strict quarantine regulations were carried out at the farms; no outside vehicles or men could enter premises without disinfecting first.

EXPERIMENTS

COMPARISON OF THE EGG PRODUCTION OF INDIAN RUNNER DUCKS AND NATIVE DUCKS

The present work is a study of the egg production of the Indian Runner ducks and of the native ducks in the shore of Laguna Lake near a river in the barrio of Alabang, Muntinlupa, Rizal. It was begun May 1, 1923.



Mestizo stallion, Property No. 703, 4 years old, used at Batangas Breeding Station. He is a grandson of stallion "Duke of Albany," an imported Morgan stallion. Height, 53 inches

Twenty-five Indian Runner ducks, 1½ years old, 5 males and 20 females and 25 native ducks of about the same age were used. They were divided into two lots according to their breed and were housed in cogon shacks of the same size near the river. Each house is provided with an inclosure in the river where they can swim. Every time there is a rise of water in the late, the houses and ducks are transferred to a higher place.

Both ducks received the same kind of feed (palay and *susô*) and practically the same treatment. The number of eggs produced and the amount of feed consumed are recorded daily.

The following tables showed the results so far obtained·

TABLE XIV.—*Egg production of Indian Runner ducks*

Months	Number of ducks		Number of eggs laid a month	Number of eggs laid by a duck	Amount of feed consumed and cost				Total cost	Remark
	M.	F.			Palay	Cost	Snails	Cost		
1923					*Kilos*		*Kilos*			
May	5	20	336	16.80	23.04	₱1.84	1,139.2	₱14.81	₱16.65	The cost per kilo of snails is ₱0.013 and that of palay is ₱0.08.
June	5	20	247	12.35	16.92	1.35	1,126.4	14.64	15.99	
July	4	20	264	13.20	19.68	1.57	1,164.8	15.14	16.71	
August	4	19	210	11.05	23.76	1.90	1,088.4	14.15	16.05	
September	4	18	149	8.28	21.60	1.73	1,152.0	14.98	17.71	
October	4	17	140	8.24	22.32	1.79	1,587.2	20.63	22.42	
November	4	17	138	8.12	23.04	1.84	1,356.4	17.63	19.47	
December	4	17	120	7.06	23.40	1.87	1,113.6	14.48	16.35	
Total	.....	.....	1,604	85.10	173.76	.....	9,728.0	.....	140.35	
Average	.....	.....	200.5	10.64	21.72	.....	1,216.0	.....	17.54	

TABLE XV.—*Egg production of native ducks*

Months	Number of ducks		Number of eggs laid a month	Average number of eggs laid by a duck	Amount of feed consumed and cost				Total cost	Remark
	M.	F.			Palay	Cost	Snails	Cost		
1923					*Kilos*		*Kilos*			
May	5	20	268	13.4	18.76	1.50	928.0	₱12.06	₱13.56	
June	4	20	472	23.6	16.92	1.35	1,126.4	14.64	15.99	
July	4	20	437	21.9	19.68	1.57	1,164.8	15.14	15.71	
August	4	20	313	15.7	23.76	1.90	1,088.4	14.15	16.04	
September	4	19	256	13.5	21.60	1.73	1,152.0	14.98	16.71	
October	4	19	249	13.1	22.32	1.79	1,190.4	15.48	17.27	
November	4	18	166	9.2	23.04	1.84	1,075.2	13.98	15.82	
December	4	18	120	6.7	23.40	1.87	1,113.6	14.48	16.35	
Total	.....	.....	2,281	117.1	169.48	.....	8,838.8	.....	128.45	
Average	.....	.....	285.1	14.64	21.18	.....	1,104.9	.....	16.06	

TABLE XVI.—*Relative weights of Indian Runner ducks and native ducks eggs*

Breeds	Number of eggs	Weight	Average weight per egg	Remarks
		grams	*grams*	
Indian runner ducks	6	498.6	83.1	Average for I. R. D. 78.85 grams.
Do	6	445.3	74.6	
Native ducks	6	356.0	59.3	Average for N. D. 67.05 grams.
Do	6	448.8	74.8	

TABLE XVII.—*Incubation*

Breeds	Date set	Number of eggs set	Number of infertile eggs	Per cent of infertile	Number of dead germs	Number of died in shell	Number of hatch	Per cent of hatch	Remarks
Native ducks	June 19	80	7.0	8.75	.....	.....	47	65.76	Natural after one week of artificial incubation.
Indian runner ducks	...do.....	50	21.0	42.00	.....	.....	5	17.24	
Native ducks	Nov. 10	118	11.0	9.32	14	41	52	48.59	Natural artificial incubation at Patero.
Indian runner ducks	...do.....	121	16.0	13.22	63	35	7	6.09	

Table XVI shows that the Indian Runner duck eggs are heavier than the native duck eggs. The average weight of the Indian Runner duck eggs is 78.85 grams; while that of the native duck eggs is 67.05 grams a difference of 10.80 grams, in favor of the Indian Runner ducks. Table XVII shows that the percentage of fertility and of hatch of the native ducks eggs are higher than those of the Indian Runner ducks.

In the first set the percentage of hatch of Indian Runner ducks was 17.24 while that of the native ducks was 65.76; and in the second set that of the Indian Runner ducks was 6.09 and the native duck eggs was 48.59 which shows a very low vitality for the Indian Runner ducks.

The experiment is still in progress and no definite conclusions can be drawn as yet.

COMPARATIVE TEST OF THE FEEDING VALUE OF SORGHUM GRAIN AND PALAY AND CORN COMBINED AS FEEDS FOR LAYING HENS

This experiment is a study of sorghum grain as a chicken feed in relation to egg production and growth of the laying hens.

The experiment was begun May 14, 1923, and is supposed to last one year from the time the experiment was commenced. This is performed at the Alabang Stock Farm.

Twenty Buff Orpington-Cantonese hens were divided into two lots of 10 each. One lot is fed with sorghum and the other palay and corn combined.

Sorghum grain is given whole. Palay and corn in the proportion one part palay and one part corn also fed whole. The weight of each hen on two lots was determined separately once a month.

The result so far obtained may be seen on the following tables:

TABLE XVIII—*Lot No. I—Sorghum*

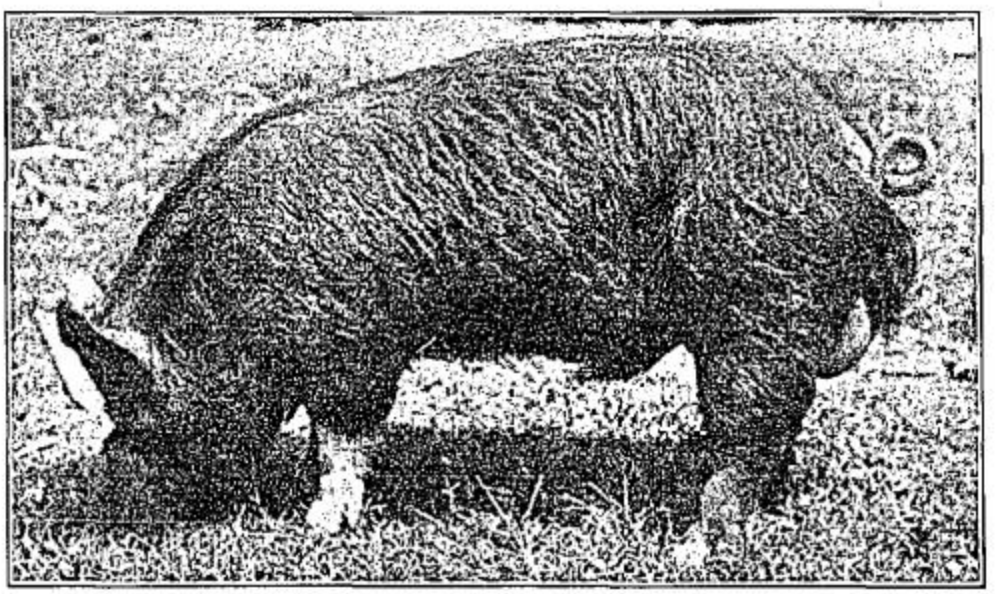
Months	Kind of feed	Number of chickens in a lot	Amount of feed consumed by a lot	Cost of feed in a lot	Cost of feed by a bird	Number of hens	Weight per lot a month	Average weight per hen a month	Increase
			kilos	*Pesos*	*Pesos*		*kilos*	*kilos*	*kilos*
May 15	Sorghum					10	14.2	1.420	
June 15	do	10	17.0	0.850	0.085	9	12.78	1.420	
July 15	do	10	18.4	.92	.092	9	12.68	1.409	.011
August 15	do	9	24.3	1.215	.135	8	11.74	1.468	.059
September 15	do	9	16.4	.820	.091	8	11.92	1.490	.022
October 1	(a)	(a)	(a)	(a)	(a)	8	13.42	1.678	
November 1	Sorghum	9	11.5	.575	.064	8	13.22	1.652	.026
December 1	do	8	6.0	.30	.038	7	11.72	1.672	.02
December 31	do	9	12.5	.625	.069	8	13.8	1.725	.053
Total			106.1		.574				.117
Average			15.16		.082				.017

TABLE XIX.—*Lot No. II—Palay and corn*

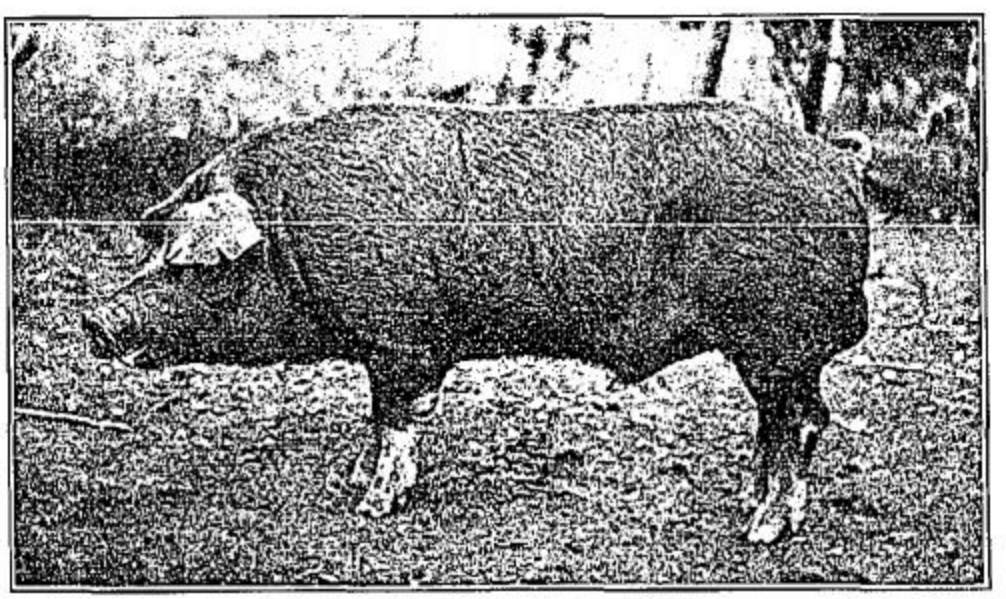
Months	Kind of feed	Number of chickens in a lot	Amount of feed consumed by a lot	Cost of feed in a lot	Cost of feed by a bird	Number of hens	Weight per lot a month	Average weight per hen a month	Increase
			kilos	*Pesos*	*Pesos*		*kilos*	*kilos*	*kilo*
May 15	Palay and corn.					10	14.32	1.432	
June 15	do	11	25.5	1.785	.162	10	15.64	1.564	.132
July 15	do	11	27.1	1.897	.172	10	15.79	1.579	.015
August 15	do	11	35.0	2.450	.223	10	16.64	1.664	.085
September 15	do	11	39.1	2.737	.249	10	16.99	1.699	.035
October 1	(a)	(a)	(a)	(a)	(a)	8	11.84	1.480	
November 1	Palay and corn.	8	16.4	1.148	.144	7	11.94	1.706	.226
December 1	do	8	9.6	.672	.084	7	11.20	1.600	.106
December 31	do	9	15.5	1.085	.121	8	11.82	1.478	.122
Total			168.2		1.155				.273
Average			24.03		.165				.039

[a] NOTE.—The experiment was temporarily stopped on September 15, 1923, and again on November 12 to 30 due to lack of sorghum grains. In the second set, beginning October, 1923, the lot formerly fed with sorghum was fed with palay and corn and vice versa.

The cost of sorghum per kilo is ₱0.05 and that of corn and palay ₱0.07 per kilo.



(*a*) A Young Berkshire boar used at Batangas Breeding Station



(*b*) A young Poland-China boar raised at Alabang Stock Farm

TABLE XX

Months	Lot number or kind of feed	Monthly egg record			Incubation of eggs				
		Number of hens	Number of eggs laid	Average per month per hen	Number of eggs set	Number of infertile egg	Percentage of infertile	Number of hatch	Percentage of hatch
1923									
May 15 to 31	Lot I—Sorghum	10	83	16.6	.....	.....	.....	.....	.....
Do	Lot II—Palay and corn.	10	80	6.0	.....	.....	.....	.....	.....
June 1 to 30	Lot I—Sorghum	9	47	5.2	45	11	24.44	32	94.12
Do	Lot II—Palay and corn.	10	62	6.2	25	2	8.00	20	86.96
July 1 to 31	Lot I—Sorghum	9	82	9.1	.....	.....	.....	.....	.....
Do	Lot II—Palay and corn.	10	86	8.6	.....	.....	.....	.....	.....
August 1 to 31	Lot I—Sorghum	8	60	7.5	153	12	7.84	107	75.88
Do	Lot II—Palay and corn.	10	71	7.1	108	15	18.89	65	69.89
September 1 to 15	Lot I—Sorghum	8	43	10.8	.....	.....	.....	.....	.....
Do	Lot II—Palay and corn.	10	13	2.6	.....	.....	.....	.....	.....
October 1 to 31	Lot II—Sorghum	8	27	3.4	.....	.....	.....	.....	.....
Do	Lot I—Palay and corn.	8	17	2.1	.....	.....	.....	.....	.....
November 1 to 30	Lot II—Sorghum	7	49	7.0	72	8	11.11	53	82.81
Do	Lot I—Palay and corn.	7	44	6.3	65	5	7.69	53	88.33
December 1 to 31	Lot II—Sorghum	7	25	3.6	.....	.....	.....	.....	.....
Do	Lot I—Palay and corn.	8	33	4.1	.....	.....	.....	.....	.....

Table XVIII shows that the average gain in weight per hen per month on the lot fed with sorghum alone is .017 kilos and the cost of the feed consumed by a hen a month is ₱0.082. In case of the lot fed with a combination of palay and corn in table XIX the average gain in weight per hen a month is .03 kilo and the cost of the feed consumed by a hen a month is ₱0.165. Therefore the lot fed with corn and palay gives a higher gain in weight of 22 grams per month than the lot fed with sorghum. The cost of production of the lot fed with corn and palay is higher than that fed with sorghum, a difference of ₱0.083 in favor of the latter.

Table XX shows that the average egg production of one hen per month fed with sorghum is 7.9 while that fed with corn and palay is 5.4 a difference of 2.5 in favor of that fed with sorghum.

The average gain in weight of one hen fed with sorghum a month is .017 kilos and the average number of eggs laid by a hen a month is 7.9. Giving ₱1 to a kilo of meat and ₱5 to a hundred of eggs the total production will then be ₱0.17 plus ₱0.385, or ₱0.402. The cost of production is ₱0.082 a hen a month. Therefore, the net profit per hen fed with sorghum a month is ₱0.402 minus ₱0.082 or ₱0.32.

In case of the hens fed with corn and palay the average gain in weight of one hen a month is .039 kilo and the number of eggs laid by a hen a month is 5.4. Estimating at ₱1 a kilo of meat and ₱5 a hundred eggs the total production will be ₱0.039 plus ₱0.27 or ₱0.309. The cost of feeding per hen a month is ₱0.165. Therefore, the net profit per hen fed with palay and corn a month is ₱0.144.

Consequently, the net profit, of ₱0.32 a hen a month on the lot fed with sorghum is higher than the net profit, of ₱0.144 a hen a month on the lot fed with corn and palay, a difference of ₱0.176 in favor of the hen fed with sorghum.

FEEDING CHICKS WITH COTABATO ADLAY

The experiment consisted of four lots of 20 chicks each. Lot I was given finely ground adlay, instead of corn meal and *binlid*, with the mixed feed in the proportion of 6 parts rice bran (higher grade), 4 parts adlay, 2 parts copra meal (low in fat) and 1 part mongo meal; Lot II and Lot III with 4 parts of *binlid* and corn meal respectively in the same proportion; and lot IV the regular mixed feed consisting of 3 parts rice bran (tiqui-tiqui), 2 parts mongo meal, 1 part corn meal, 2 parts copra meal (*low in fat*) and 1 part *binlid*. This last lot was used as chek in the experiment. The nutritive value of Lots I, II, III and IV are 1:5.1; 1:5.5; 1:5.6; and 1:4.0, respectively.

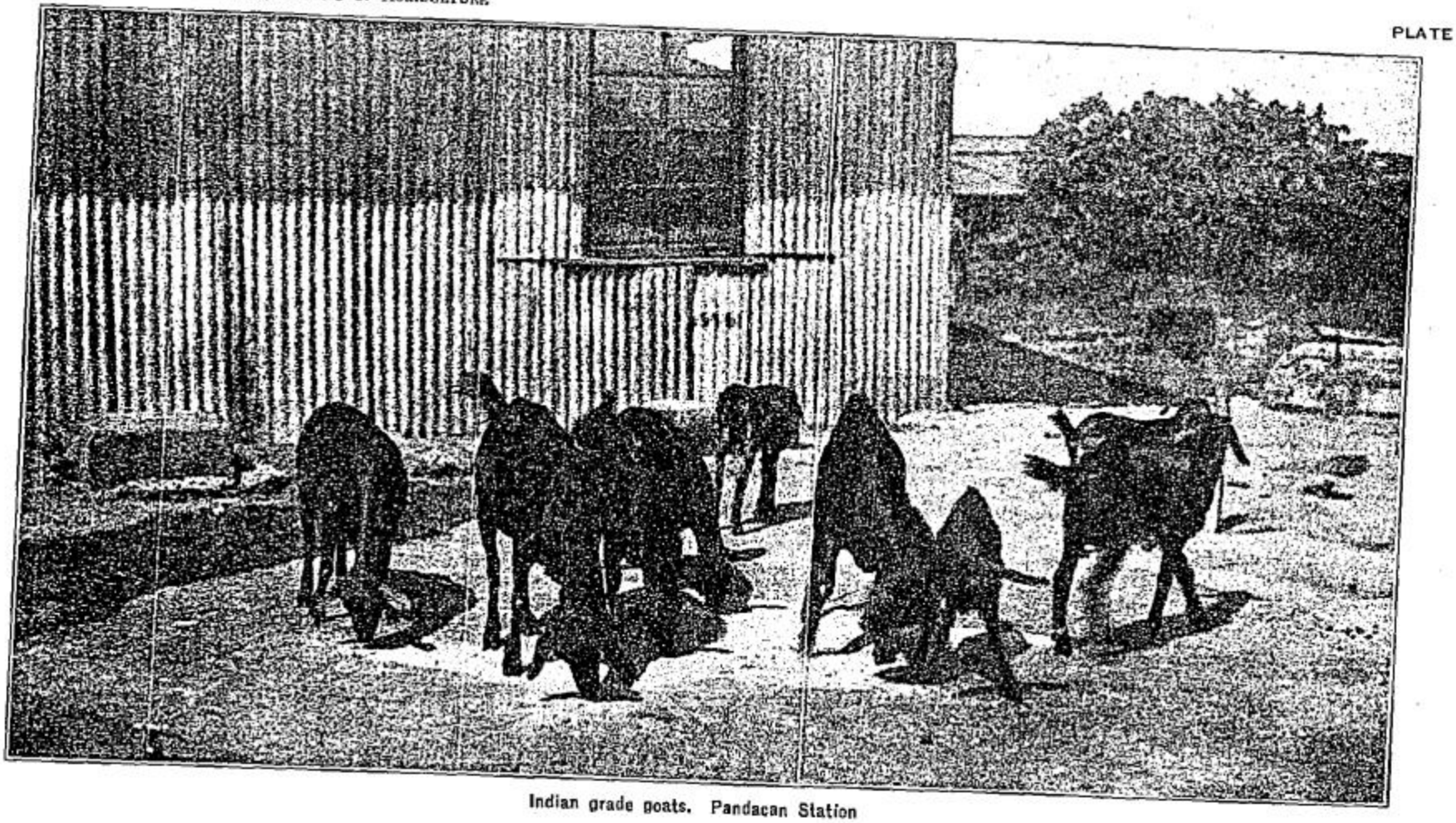
The experiment lasted 10 weeks from April 26, 1923, to June 28, 1923. Each lot was weighed every week to determine the weekly gain. At the end of the experiment, the average weekly gain of each chick in each lot was:

For adlay	19.06
For binlid	13.91
For corn	18.44
For check	17.71

The percentage of mortality were 50, 73.68, 78.95 and 75, respectively.

This result indicates that the Cotabato adlay is a good chick feed and in this experiment proved better than corn and *binlid* (the regular feed given at the farm) and it is claimed that its cost of production is very much lower than palay or corn.

This is a preliminary report on the experiment and it will be repeated at some other time in order to make a definite conclusion.



Indian grade goats. Pandacan Station

CROSS BREEDING EXPERIMENTS WITH CHICKENS

Cross breeding experiments are being conducted at the Alabang Stock Farm. The purpose of cross breeding is to ascertain in the future a strain that would be more suitable to raise under Philippine conditions, larger sized chickens and at the same time is high egg producer than the native. The cross breeding experiments are as follows:

Black Native with Silver Laced Wyandotte.
White Leghorn with Black Native–Black Orpington.
White Leghorn with Black Minorca–Black Native.
Black Minorca with Native.
White Leghorn with Buff Orpington–Cantonese.
Brown Leghorn with Orpington Cantonese.
White Leghorn with ¾ Buff Orpington–¼ Cantonese.
Buff Orpington with Cantonese.
Buff Orpington with ¾ Buff Orpington–¼ Cantonese.
Buff Orpington with Buff Orpington–Cantonese.
White Leghorn with Cantonese.
White Leg-B. Orp.-Cant. with White Leghorn–Buff Orpington-Cantonese.

Of these the White Leghorn-Buff Orpington-Cantonese promises to be the most sucessful but it will require a few more years to arrive at some definite conclusion.

THE AYRSHIRE-NELLOR CROSS

On April 8, 1921, an Ayrshire bull was purchased from a local breeder for ₱2,000 and was sent to Alabang Stock Farm to cross with several Nellore cows that were gradually placed with him at the time they dropped their calves.

At first the bull would always stay under shelter as if it feared the hot sunshine and it was feared no results would be obtained from it. It was therefore deemed best to keep him in a stable during the day where he could be attended as a well-groomed stallion would be, and at night it was put with the cows in the corral. During the rainy days it was allowed to pasture in the open as it seemed to enjoy the rain. In 1922, it has 2 male calves that showed characteristics of both breeds. This year it again produced 2 male calves in February, 2 female calves in March, and in December another 2 female calves and one male calf. The young are very promising stock and that there are several pregnant crows which are expected to drop their calves early next year.

MILK PRODUCTION OF NELLORE COWS THAT HAD BEEN CROSSED TO AN AYRSHIRE BULL

With a view of comparing the milk production of the resulting cross of the Ayrshire bull with the Nellore cows, it has been deemed advisable to keep a record of the amount of milk which could be produced by the pure Nellore dams. It must be taken into account that no extra feed was given these dams other than what they could find in the Alabang pasture. The milking was done only once a day, early in the morning before turning the herd out into the field. By this it will be understood that the calves were separated during the night from their dams.

Milking was started on May 1, when the calves were considered strong enough to withstand separation from the dam, during the night and to sucking to only a little milk in the morning.

Monthly milk record

Cows No.	May	June	July	August	September	October	November	December
3	12.06	26.6	27.9	26.95	25.29	20.05	17.00	16.78
264	17.96	17.02	18.4	23.21	17.47	15.82	17.12	[a] 8.35
345	18.69	17.47	18.4	(a)	(a)	(a)	(a)	(a)

[a] Milking stopped, dam getting thin.
[b] 12 days only.
[c] 19 days only.

Cow No. 3.—Begun milking when calf was 2 months and 19 days old.

Cow No. 264.—Begun milking when calf was 1 month and 9 days old.

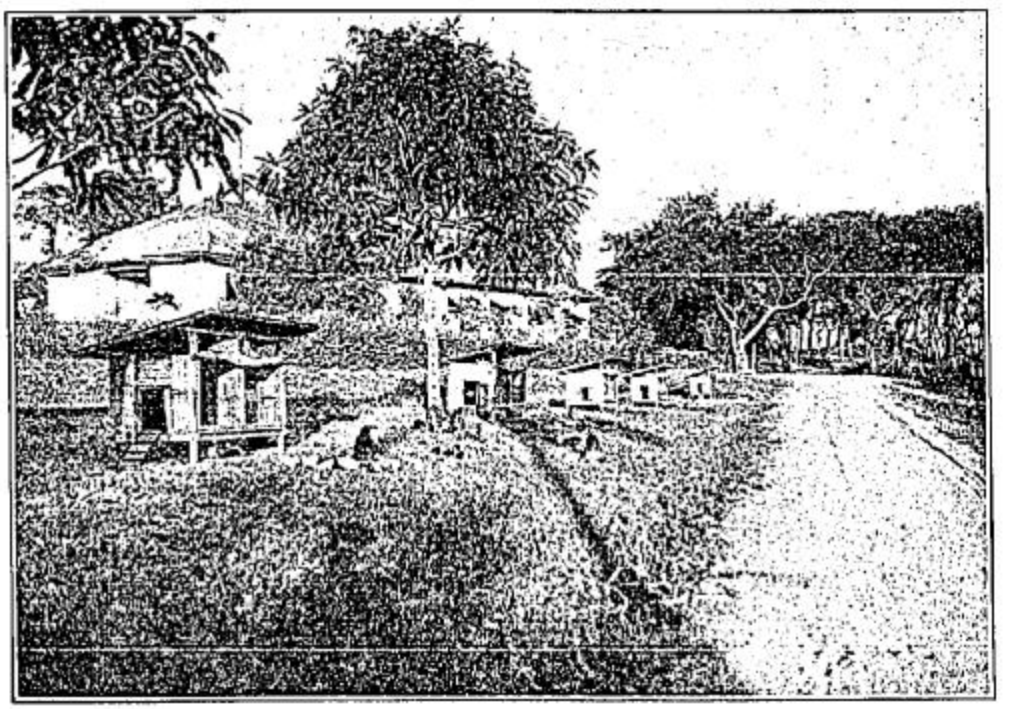
Cow No. 345.—Begun milking when calf was 1 month and 21 days old.

This record credits No. 3 with .7 liter per day, No. 264 with .58 liter and No. 345 with .59 liter which of course, are poor milk records; however, the Nellores are only a work type which has been used in preference to the native cows that are very susceptible to rinderpest. It would have been better if Multani cows had been used but thse were not available at the farm. (The Multani is an Indian milk breed.)

TEST ON THE MILK PRODUCTION OF SOME NANNY GOATS AT ALABANG STOCK FARM

In order to obtain data on the milk production of some of the nanny goats at this farm so as to satisfy the inquiries made by buyers, it has been thought best to keep some record on milking.

(a) Embdon geese on the free range at Alabang Stock Farm



(b) Brood coops for hens with chicks, used at Alabang Stock Farm

The nanny goats under test were separated from the kids during the night but were allowed to go with them during the day. The feed consisted of the native pasture and shrubs found in the fields. No other food was given.

TABLE XXII.—*Monthly milk record*

Nanny No.—	Breed	Age	May	June	July	August
		Years				
786	Spanish grade	3	[a]9.18	18.88	17.90	16.30
546	do	7	[b]15.94	21.9	18.60	20.14
881	Indian grade	1				17.14
819	Spanish grade	2½				
861	do	2				
Average						

Nanny No.—	Breed	Age	September	October	November	December
		Years				
786	Spanish grade	3				
546	do	7	18.11	14.00		
881	Indian grade	1	17.40	11.75	[c]4.85	
819	Spanish grade	2½		12.46	12.03	
861	do	2		13.80	11.70	13.94
Average						

[a] 18 days only. [b] 21 days only. [c] 17 days only.

Daily average 786.... 59. liter. Begun milking when kid 1 month 5 days old.
Daily average 546.... .62 liter. Begun milking when kid 1 month 11 days old.
Daily average 881.... .47 liter. Begun milking when kid 1 month 26 days old.
Daily average 819.... .40 liter. Begun milking when kid 1 month 24 days old.
Daily average 861.... .43 liter. Begun milking when kid 1 month 21 days old.

Average ..... .50 liter.

From the above record, it will be seen that the older nannies had better milk records and that the Indian grade although younger than nannies 819 and 861 made a comparatively better record. The average for the milk goats was one-half liter. Considering that no extra nutritious food was given and that only one milking was made a day the record is a satisfactory one. If these milkings were made continually and from year to year the udder could be developed to produce a larger amount of milk and with the aid concentrated feed, very promising result could be obtained.

A TEST OF THE WEEKLY INCREASE IN WEIGHT OF KIDS

The purpose of this test was to determine the weekly increase in weight of kids of the goat herd at Alabang Stock Farm. The dams were allowed free range in the pastures during the day and were penned up during the night. No extra feed was given.

A few days after the kids were dropped, weekly weighings were begun. The following shows the results of the weighings:

TABLE XXIII

Date	No. I		No. II		No. III		No. IV		Remarks
	Weight	Increase	Weight	Increase	Weight	Increase	Weight	Increase	
1923	kilos	kilos	kilos	kilos	kilos	kilos	kilos	kilos	
					1-1.8				No. I—Breed sire.
					2-1.6				Indian 774—Dam grade.
July 6	2.4		2.0		1-3.2	1.4	1-3.1		Breed No. I, Indian grade.
	4.4	2.0	3.6	1.6	2-3.0	1.4	2-3.0		Dropped, July 2, 1923—1 M.
July 14					1-3.8	.6	1-4.0	.9	No. II—Breed sire.
	5.4	1.0	5.0	1.4	2-4.0	1.0	2-3.2	.2	Grade 811—Dam grade.
July 21					1-4.4	.6	1-4.9	.9	Breed No. II, grade.
	6.6	1.2	5.5	.5	2-4.3	.3	2-4.3	1.1	Dropped, July 5, 1923—1 M.
July 28					1-5.2	.8	1-5.8	.9	No. III, Sire 708, Indian.
	6.8	.2	6.4	.9	2-4.8	.5	2-4.4	.1	Dam 733—Grade.
August 4					1-5.7	.5	1-6.0	.2	Breed No. III, Indian grade.
	6.9	.1	6.4		2-4.9	.1	2-5.0	.6	Dropped, July 5, 1923—2 F.
August 11					1-6.1	.4	1-6.6	.6	No. IV—Sire 708, Indian.
	7.0	.1	6.6	.2	2-5.0	.1	2-5.2	.2	Dam 732, Grade Sire Indian.
August 18					1-6.0	.1	1-7.4	.8	Breed No. LV, Indian grade.
	7.5	.6	6.9	.3	2-5.4	.4	2-5.2		Dropped, July 9, 1923—2 F.
August 25					1-6.8	.3	1-7.9	.5	
	8.4	.8	8.0	1.1	2-6.4	1.0	2-5.6	.4	
August 31					1-7.4	.6	1-8.4	.5	
			8.6	.6	2-6.4		2-6.0	.4	
September 9					1-7.8	.4	1-8.6	.2	
	8.4		8.8	.2	2-6.2	.2	2-6.0		
September 16					1-8.0	.2	1-9.1	.5	
	8.8	.4	9.3	.5	2-6.8	.6	2-6.7	.7	
September 23					1-8.2	.2	1-9.4	.2	
	9.0	.2	9.5	.2	2-7.4	.6	2-7.0	.3	
September 30					1-8.4	.2	1-9.6	.2	
	9.6	.6	9.8	.3	2-7.6	.1	2-7.4	.4	
October 7					1-8.4		1-9.9	.3	
	10.4	.8	10.0	.2	2-7.6	.1	2-7.1	.3	
October 15					1-9.2	.8	1-9.4	.5	
	11.2	.8	11.6	1.6	2-8.2	.6	2-7.6	.5	
October 28					1-10.1	.9	1-9.8	.4	
	11.9	.7	12.7	1.1	2-8.9	.7	2-8.2	.6	
November 4									
Average weekly increase		.59		.67		.52 .46		.45 .39	

According to these results, it will be seen that the weekly increase of single kids is greater than the duplets, although the total increase of the latter gives a higher increase in weight than the former. The average weekly increase of all the kids is only one-half kilo each.

Sales of Bureau animals for the year 1923

Stations	Horses		Cattle		Swine		Goats	
	No.	Price	No.	Price	No.	Price	No.	Price ice
Alabang Stock Farm	4	₱70.00	3	₱205.00	266	₱4,886.03	17	₱178.00
La Carlota Experimental Station			61	5,311.00	10	241.00	2	7.00
Cebu Breeding Station					18	495.00		
Batangas Breeding Station			2	167.00	14	68.50		
Iloilo Poultry-Swine Station					1	2.00		
San Antonio Poultry-Swine Station					33	180.65		
Tiaong Poultry-Swine Station					2	22.00		
Pandacan Chicken House			10	650.05	12	154.00	3	30.00
Miscellaneous (transportation, crates, bills, egg boxes, breeding services, feeds, charcoal and others)								
Total	4	70.00	76	6,333.05	355	6,049.18	22	215.00

Sales of Bureau animals for the year 1923—Continued

Stations	Sheep		Poultry		Eggs		Total	
	No.	Price	No.	Price	No.	Price	No.	Price
Alabang Stock Farm	16	₱175.00	370	₱1,123.40	4,013	₱779.60	4,589	₱7,417.03
La Carlota Experimental Station	20	96.20	145	153.05	884	132.55	1,122	5,940.80
Cebu Breeding Station	.....	.....	108	224.50	3,178	277.97	3,304	997.47
Batangas Breeding Station	.....	.....	40	61.90	399	34.84	455	332.24
Iloilo Poultry-Swine Station	.....	.....	33	72.95	365	72.71	399	147.66
San Antonio Poultry-Swine Station	.....	.....	33	23.15	630	18.95	695	222.75
Tiaong Poultry-Swine Station	.....	.....	9	23.00	.....	.....	11	45.00
Pandacan Chicken House	3	13.50	.....	.....	.....	.....	28	847.55
Miscellaneous (transportation, crates, bills, egg boxes, breeding services, feeds, charcoal and others)	.....	.....	.....	.....	.....	.....	.....	1,387.54
Total	39	284.70	738	1,681.95	9,469	1,316.62	10,703	17,338.04

NOTE.—Three sheep sold at Los Baños and one boar sold at Buntoc were credited to the Alabang Stock Farm.

RECOMMENDATIONS

The purchase of some horses, cattle, sheep, goats, swine, and poultry is imperative and is strongly urged because some of the present stock is old, especially the stallions, while practically all the live stock requires renewing of blood. At least ₱20,000 should be appropriated for this purpose.

Repairs.—For several years, some repairs of the buildings at Alabang, Cebu, La Carlota, and San Antonio have been needed. The recent typhoon has made things worse and some buildings had their roofs completely torn down. At least ₱10,000 should be set aside for this purpose.

New improvements.—To properly conduct the experiments in feeding and extensive cross breeding of poultry it is again recommended the construction of an experimental house with yards constructed at Alabang Stock Farm. It is estimated that a house for this purpose would cost about ₱5,000 but it is believed it will more than pay for itself for the amount of good it will turn out.

There is also a need of an appropriation for movable pig fences to be used in forage feed lots for determining the valuable forages for hogs. Five hundred pesos should be sufficient for this purpose.

Technical employees.—To better carry on the present work, it is recommended that provisions be made for two extra techni-

cal employees to be put in charge of projects that are at present handled by one person.

Act 2758.—Inasmuch as the technical advice of the Animal Husbandry Division is constantly used in managing this act, this project should be placed under the full control of the Bureau of Agriculture, as it will reduce expenses in personnel and it may use such savings for other animal husbandry work.

ANIMAL INSURANCE DIVISION

During the year the personnel of the Insurance Division consisted of three employees only. The activities of this division were confined only to the continuance of the previous operation of the Work Animal Insurance Society. A partial statement of the work of the association for the period from May, 1920 to December 31, 1923 herewith follows:

TABLE XXV

Provinces	Animals insured	Amount collected		Total	Number of deaths	Indemnities paid
		Fees	Premiums			
Abra	198	₱105.00	₱1,403.25	₱1,508.25	22	₱1,858.50
Albay	126	50.00	681.25	731.25	22	2,319.00
Antique	32	65.00	261.50	326.50	12	1,360.00
Bataan	171	112.00	1,325.75	1,437.75	18	2,126.00
Batangas	938	390.00	6,118.30	6,508.30	27	2,516.60
Bulacan	295	328.00	2,235.75	2,653.75	29	3,187.00
Cagayan	0	16.00	.....	16.00	00	.....
Camarines Norte	45	59.00	252.50	311.50	3	278.90
Camarines Sur	625	154.00	5,266.00	5,420.00	36	2,926.25
Capiz	958	428.00	7,339.45	7,767.45	185	21,785.22
Cavite	308	91.00	2,622.25	2,713.25	68	8,212.50
Cebu	421	160.00	2,946.50	3,106.50	25	2,241.40
Ilocos Norte	56	81.00	289.85	373.85	1	56.00
Ilocos Sur	80	90.00	432.00	522.00	4	303.00
Iloilo	957	485.00	8,264.30	8,749.30	76	9,076.00
Laguna	879	401.00	7,424.10	7,825.10	156	19,621.00
La Union	288	651.00	1,326.75	1,977.75	10	701.66
Leyte	.....	1.00	.....	1.00	.....	.....
Mindoro	566	12.00	5,640.20	5,652.20	15	2,394.00
Nueva Ecija	590	172.00	4,704.85	4,876.85	22	2,750.00
Occidental Negros	1,371	796.00	11,227.26	12,023.26	121	17,472.27
Pampanga	1,187	408.00	9,588.80	9,986.80	60	6,886.00
Pangasinan	431	368.00	2,799.00	3,167.00	12	1,112.50
Rizal	571	302.00	4,333.10	4,635.10	30	3,405.00
Romblon	23	11.00	135.50	146.50	1	144.00
Romblon	23	11.00	135.50	146.50	1	144.00
Tarlac	104	162.00	1,712.25	1,864.25	2	190.00
Tayabas	61	39.00	480.50	519.50	1	120.95
Zambales	.....	15.00	.....	15.00	.....	.....
Total	11,160	5,945.00	88,810.46	94,755.96	959	113,048.75

It will be noted from the foregoing that payments for indemnities exceeded the collections from premiums in the amount of ₱18,292.79 which was covered by the allotment voted in the Work Animals Insurance Law. This would not have been the

case if the operations of the Insurance had not been suspended, and the sources from which indemnities were paid were cut off. The result naturally was that the Association had to use the funds appropriated by law.

Had the idea of increasing the rate of premiums in proportion to the rate of mortality been carried out as was proposed in order to check the increasing number of losses, perhaps the result would have been different. From May, 1920, to December 31, 1923, inclusive, there were 11,281 draft animals insured and 959 died. The rate of mortality, therefore, was 8.5 per cent which rate would have been in proportion to the rate of premium charged.

AGRICULTURAL EXTENSION DIVISION

This division handles the greater part of the information service regarding farm activities of the country; supplies seed and plant materials as far as possible either direct from the Central Office or through its fieldsmen; wages food production campaign which quite effectively prevents food shortage in districts badly hit by typhoons, devastated by locust or affected by drought or floods; and assists other divisions in their field work, as for instance, in the campaigns against locuts, anthrax, as well as in securing data and plant materials for investigational purposes.

The services of the agricultural extension agents in the field have been and are still sought in many places as shown by the fact that many resolutions from municipal councils and provincial boards as well as personal requests of provincial governors and representatives for field agents for their towns or provinces have been received. Lack of funds to employ additional agents prevents the division from extending its services to places not presently covered by the field force, but efforts are always made to do as much as possible. As a matter of fact, the accomplishments pass our expectations. Figures will be seen elsewhere in this report to substantiate this claim.

On the whole, the full coöperation of the provincial and municipal officials and of the people has contributed a great deal to the success obtained so far in the work of the division.

PERSONNEL

The Central Office force at the beginning of the year consisted of the acting chief of the division, one assistant agronomist, dis-

charging the duties of the assistant chief, one assistant in agronomy, one assistant in horticulture, one agricultural extension agent assigned as assistant in the organization of Producers' Association, one agricultural extension agent serving as assistant in doing miscellaneous office work, one stenographer, two clerk-typists, one record clerk, two laborers attending to seed and plant distribution and one messenger.

For the ensuing year, 1924, a request for 12 new positions was made so as to enable the division to extend the field activities to more provinces.

FIELD FORCE

The field force during the year consisted of 24 agricultural extension agents and 16 assistants. Of this, nine are in charge of provincial nurseries and demonstration stations, as well as doing field extension work in their districts.

REORGANIZATION AND PRACTICAL TRAINING OF THE FIELDMEN

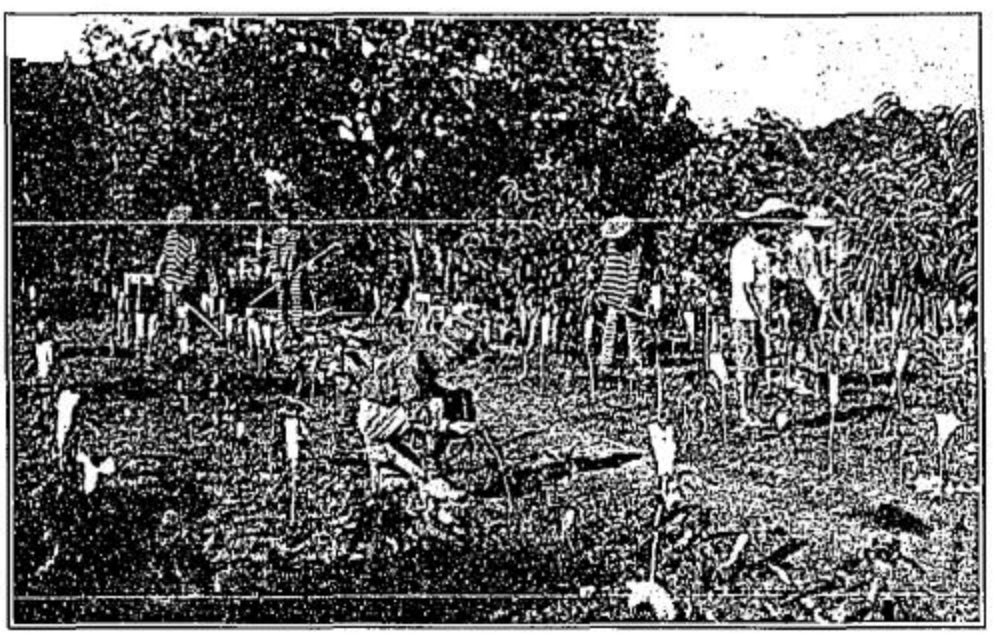
In accordance with the reorganization plan which was made effective in November, 1922, the fieldmen of the division were called in from their respective stations and temporarily detailed to the nearby experiment stations, namely, Lamao Experiment Station, Alabang Stock Farm, Tanauan Citrus Station, and Singalong Propagating and Testing Station, where they were given practical training in matters calculated to equip them for more acceptable service to the farmers.

FIELD ASSIGNMENTS IN ACCORDANCE WITH THE REORGANIZATION PLAN

After the training period, which lasted until the second week of March, the fieldmen were assigned to certain provinces, mostly around Manila.

The main idea in the reorganization so effected was to be able to make a closer supervision and to concentrate the efforts of the fieldmen by dividing the province into small districts with special attention to the development of a particular line of agriculture which needs improvement and make such modifications therein as may be possible to get definite and tangible results within a short time, instead of taking up many projects and leaving them unfinished.

(a) Agricultural Extension agents who attended the annual convention of 1923 together with provincial officials of Laguna in a visit to Santa Cruz Provincial Nursery, Laguna



(b) A partial view of Santa Cruz Provincial Nursery

PROJECTS, ACTIVITIES, AND ACCOMPLISHMENTS

In acordance with the reorganization plan, the work of the division was divided into projects with the view to concentrating the efforts of fieldmen, as follows:

1. The organization of local producers' associations.
2. Coöperative marketing.
3. Horticulture campaign.
4. Milk industry campaign.
5. Poultry and ducks campaign.
6. Swine industry campaign.
7. Vegetable growing campaign.
8. Provincial nurseries and demonstration stations.

SPECIAL PROJECTS

9. Rice production campaign.
10. Tobacco production campaign.
11. Sugar cane production campaign.
12. Abaca production campaign.

The organization of Local Producers' Associations.—To give the producers legitimate returns for their labor by eliminating middlemen; to save them from the clutches of usurers and profiteers, who always prey upon the unorganized small farmers; to encourage the development of the local industries and others that are capable of development, and as a whole to improve and make the country people contented and prosperous—are the chief aims of organizing producers' associations.

An intensive campaign was started in April, 1923 and attempts were made to organize associations of milk producers, poultry raisers, fruit growers and tobacco producers, vegetable raisers and other producers of agricultural crops in the district where the agents have been assigned. In the beginning, many difficulties and troubles were encountered in organizing the producers' associations. Much pessimism was met with though later some of the people grew very enthusiastic. The most difficult part of the work of the agents is:

1. To convince the people of the advantages of coöperative associations, especially in the marketing of their products, this idea being newly introduced into the country,
2. To prevail on the intelligent farmers, especially of the younger generation to gain the approval of the old and generally conservative farmers, and
3. To get the confidence of the people as a whole in the undertaking.

The following table shows the main activities in the organization work and the number of local producers' coöperative association organized during the year:

TABLE XXVI

Province	Municipality	Barrios	Organized	Kind of associations
Rizal	Caloocan	Balintawak	4-16-23	Poultry Producers' Association.
Do.	do.	Bagobantay	4-18-23	Do.
Do.	do.	Pasong Tamo	4-19-23	Do.
Do.	do.	Talipapa	4-20-23	Do.
Do.	do.	Novaliches	4-23-23	Do.
Do.	do.	Balintawak	4-16-23	Milk Coöperative Producers' Association.
Do.	do.	Bagobantay	4-18-23	Do.
Do.	do.	Pasong Tamo	4-19-23	Do.
Do.	do.	Novaliches	4-23-23	Do.
Do.	do.	Talipapa	4-19-23	Rizal Farm Mercantile Coöperative Association
Do.	Pasay	Culiculi	4-26-23	Milk Coöperative Producers' Association.
Do.	Muntinglupa	Alabang	4- 6-23	Do.
Pampanga	San Fernando	Poblacion	4-29-23	Do.
Bulacan	Baliuag	Tarcan	5-10-23	Do.
Do.	San Rafael	Maasim	5-10-23	Do.
Do.	Bulacan	Poblacion	8-19-23	Poultry Coöperative Association.
Do.	Quingua	do.	7- 8-23	Do.
Do.	Tanay	do.	7-15-23	Mango Coöperative Association.
Do.	Pulilan	do.	7-27-23	Do.
Do.	Bustos	do.	7-27-23	Do.
Rizal	Las Piñas	do.	7-15-23	Do.
Do.	Cainta	do.	7-15-23	Do.
Do.	Taytay	do.	7-15-23	Do.
Batangas	Santo Tomas	Sta. Anastacia	6-14-23	Coöperative Marketing Vegetables Association.
Do.	Lipa	Poblacion	7- 7-23	Poultry Coöperative Association.
Do.	Rosario	do.	7- 8-23	Do.
Laguna	Nagcarlan	do.	8- 9-23	Copra Coöperative Producers' Association.
Do.	Calamba	do.	6- 9-23	Banana Coöperative Producers' Association.
Cavite	Silang	do.	7-22-23	Papaya Coöperative Producers' Association.
Isabela	Jones	Nemmatan	9-17-23	Tobacco Coöperative Producers' Association.

TABLE XXVII.—*Table showing those that are in actual operation*

Province	Municipality	Barrios	Organized	Kind of associations
Rizal	Caloocan	Talipapa	4-19-23	Rizal Farm Mercantile Coöperative Association.
Do.	Muntinglupa	Alabang	4- 6-23	Milk Coöperative Producers' Association.
Do.	Taytay	Poblacion	7-15-23	Mango Coöperative Association.
Bulacan	Baliuag	Tarcan	5-10-23	Milk Coöperative Producers' Association.
Do.	Quingua	Poblacion	7- 8-23	Poultry Coöperative Association.
Pampanga	San Fernando	do.	4-29-23	San Fernando Pampanga Milk Industry.
Batangas	Santo Tomas	Sta. Anastacia	6-14-23	Coöperative Marketing Vegetable Association.
Laguna	Calamba	Poblacion	7- 8-23	Banana Coöperative Producers' Association.
Do.	Nagcarlang	do.	12-14-23	Banahaw and San Cristobal Producers' Association.
Cavite	Silang	do.	7-22-23	Papaya Coöperative Producers' Association.
Isabela	Jones	Nemmatan	9-17-23	Tobacco Coöperative Producers' Association.

It can thus be seen that organization of this nature are quite difficult to start and keep alive in the Philippines. Experience in other countries like America and Europe much more advanced agriculturally than ours in the organization of producers' cooperative associations, teaches that time and devotion to the tasks are necessary to successfully form said associations.

With ours, therefore, there need be no surprise if no great immediate results are obtained along this direction. That farmers now realize the value of grouping themselves in an association for marketing their products and thus eliminating the middlemen is a step forward.

With the view to assisting the proper functioning of the different associations, the Central Office is conducting a campaign in Manila to find good markets for the products of the different associations. As a start two central agencies of milk producers' associations were established in Manila during the year to handle the products of the different milk producers' associations. Only fresh milk was furnished by said agencies and through them quite a reputation in Manila has been established by the local milk. There was also an agency of milk put in the province as in San Fernando, Pampanga, where milk has been handled in quite big scale. Local sales have been quite extensively made. Both agencies boil their milk and put it in sterilized bottles with sanitary parafined paper covers. Competition between local milk producers and the pernicious practice of adulterating milk before it is sold are also responsible for the slow progress in this work. The Bureau, through the field agents entrusted with in this campaign has, however, greatly helped the consumers in that adulterating and watering of milk has been minimized through the inspection and at times in the use of lactometers. The fieldmen through their association with the milk producers have encouraged the farmers in the sanitary handling of their milk and also in the use of proper feed for their animals to enable them to produce more milk. In some regions though, the quantity of milk produced was increased to some extent as animals never milked before are being milked now.

But because of the outbreak of anthrax in October the activities for milk production have been suspended temporarily, but they will resume as soon as the disease is suppressed and the quarantine lifted.

In the case of the banana and papaya fruit growers' associations, arrangements have been made to market their products with the Manila Fruit Company and the National Fruit Company established in the city. These products are also sold to private dealers in the city but this does not insure regular sales. Efforts are being made to connect the different associations with the consumers here in the city such as big hotels and the ocean steamers that call in Manila. As a whole the marketing problem always stands in the way for the rapid progress of the work of the associations.

TABLE XXVI

Province	Municipality	Barrios	Organized	Kind of associations
Rizal	Caloocan	Balintawak	4-16-23	Poultry Producers' Association.
Do.	do.	Bagobantay	4-18-23	Do.
Do.	do.	Pasong Tamo	4-19-23	Do.
Do.	do.	Talipapa	4-20-23	Do.
Do.	do.	Novaliches	4-23-23	Do.
Do.	do.	Balintawak	4-16-23	Milk Coöperative Producers' Association.
Do.	do.	Bagobantay	4-18-23	Do.
Do.	do.	Pasong Tamo	4-19-23	Do.
Do.	do.	Novaliches	4-23-23	Do.
Do.	do.	Talipapa	4-19-23	Rizal Farm Mercantile Coöperative Association
Do.	Pasay	Culiculi	4-26-23	Milk Coöperative Producers' Association.
Do.	Muntinglupa	Alabang	4- 6-23	Do.
Pampanga	San Fernando	Poblacion	4-29-23	Do.
Bulacan	Baliuag	Tarcan	5-10-23	Do.
Do.	San Rafael	Maasim	5-10-23	Do.
Do.	Bulacan	Poblacion	8-19-23	Poultry Coöperative Association.
Do.	Quingua	do.	7- 8-23	Do.
Do.	Tanay	do.	7-15-23	Mango Coöperative Association.
Do.	Pulilan	do.	7-27-23	Do.
Do.	Bustos	do.	7-27-23	Do.
Rizal	Las Piñas	do.	7-15-23	Do.
Do.	Cainta	do.	7-15-23	Do.
Do.	Taytay	do.	7-15-23	Do.
Batangas	Santo Tomas	Sta. Anastacia	6-14-23	Coöperative Marketing Vegetables Association.
Do.	Lipa	Poblacion	7- 7-23	Poultry Coöperative Association.
Do.	Rosario	do.	7- 8-23	Do.
Laguna	Nagcarlan	do.	8- 9-23	Copra Coöperative Producers' Association.
Do.	Calamba	do.	6- 9-23	Banana Coöperative Producers' Association.
Cavite	Silang	do.	7-22-23	Papaya Coöperative Producers' Association.
Isabela	Jones	Nemmatan	9-17-23	Tobacco Coöperative Producers' Association.

TABLE XXVII.—*Table showing those that are in actual operation*

Province	Municipality	Barrios	Organized	Kind of associations
Rizal	Caloocan	Talipapa	4-19-23	Rizal Farm Mercantile Coöperative Association.
Do.	Muntinglupa	Alabang	4- 6-23	Milk Coöperative Producers' Association.
Do.	Taytay	Poblacion	7-15-23	Mango Coöperative Association.
Bulacan	Baliuag	Tarcan	5-10-23	Milk Coöperative Producers' Association.
Do.	Quingua	Poblacion	7- 8-23	Poultry Coöperative Association.
Pampanga	San Fernando	do.	4-29-23	San Fernando Pampanga Milk Industry.
Batangas	Santo Tomas	Sta. Anastacia	6-14-23	Coöperative Marketing Vegetable Association.
Laguna	Calamba	Poblacion	7- 8-23	Banana Coöperative Producers' Association.
Do.	Nagcarlang	do.	12-14-23	Banahaw and San Cristobal Producers' Association.
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The poultry raisers' coöperative organizations, of which there are two prominent ones, were unable to send to Manila any of their products not having enough materials on hand as the organizations have just been organized. The Quiñgua and Bulacan poultry raisers' coöperative associations are progressing. Their main activities are in the increased production and the building of proper quarters for the chickens.

The only Tobacco Coöperative Producers' Association so far considered to be fairly well organized is that of Nemmatan, Jones, Isabela. Although no big transactions have been made by this association, the campaign for better methods of culture and handling of tobacco products is considered very valuable.

The Mango Growers' Coöperative Association in the town of Taytay, Rizal, has already made a good start. The main activities so far have been with regard to the smudging of the trees. Individual members have tried the smudging method and trees which never fruited before have been induced to flower and fruit this season. Individual nurseries for mangoes have also been established in several places with the view to increasing the hectarage and ultimately to increase the production.

Horticultural campaign.—This year the Bureau waged the most active campaign for the growing of fruits ever waged before. The Philippines has an unlimited field for the development of the industry and a vast number of good fruits which if grown extensively would mean a saving annually of millions of pesos through the reduction of importation of foreign fruits and by the possible exportation of mangoes, bananas, and other fruits not hitherto exported, and besides about 50 per cent of the fruit trees already growing now are not producing any fruits but could be made so by smudging, pruning, top-working, and proper cultivation such as practised with the citrus trees and mangoes, especially. This is one of the main works of the division. Smudging mangoes for instance has been started by the extension agents in their districts where it has not been done before thus causing some mango trees that never fruited at all to bear this year for the first time.

Due to the limited field force, however, the campaign has been confined mostly to the towns of Cavite, Bulacan, Rizal, Batangas, Laguna, Pangasinan, and La Union although activities have also been started in other provinces at the request of some farmers. Preferable attention was given to the improvement of mangoes, citrus, coffee, pineapple, and lanzon but in fact all other fruit trees of economic importance were attended to.

The materials distributed by the division were as far as possible grafted or budded plants especially mangoes, lanzon, santol, and citrus; the idea being to shorten the fruiting season which is prolonged in the case of seedling besides the fact that the quality of fruit is improved by getting the scions from trees of good quality. The campaign has gone to the extend of doing the budding or grafting work for the farmers right on their farms for demonstration purposes and as a result many farmers have already been attended to as will be seen elsewhere in this report.

The following table shows the total number of different fruit trees planted in the districts covered by the extension agents. The materials were either supplied by the Bureau or planted or procured through the help of agents.

Bananas	133,776
Cacao	30,959
Chico	265
Citrus	35,361
Coconuts	85,499
Coffee	95,606
Lanzon	3,149
Mango	18,173
Miscellaneous fruit trees	11,430
Nangka	3,573
Papayas	216,838
Pineapples	102,891
Total	726,090
Miscellaneous root crops	89,700

The work of the field agents have been more appreciated by the farmers as ocular or practical demonstration was more emphasized this year instead of giving talks and lectures. They have performed actual practical demonstration on the proper care of orchards and fields, laying out new orchards and renewing old one. There were 2,735 trees grafted, 577 budded, 680 marcotted, and 2,059 pruned or top worked also.

The grafting of mangoes along the provincial roads in the provinces around Manila has been done this year for the first time. At least 1,000 plants along the roads from Dagupan to Urdaneta, Pangasinan, were grafted within a month. This work will be continued until all the mangoes in the roads of Pangasinan are grafted. The campaign was started in that province as it is the only one nearest to Manila that has mango seedlings at the right age for grafting. Similar work will be started in Bataan. The purpose of the campaign is to shorten the time for it to bear fruit as well as for demonstration purpose.

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This practical demonstration has greatly impressed the people and the big farmers of Pangasinan Province in particular and as a result, requests to graft mango trees in their own plantations have been received. One man of the division has been detailed to this work and it is the plan to extend this campaign of grafting mangoes on a large scale and also on citrus, santol, lanzon, and other fruit trees where stocks are available.

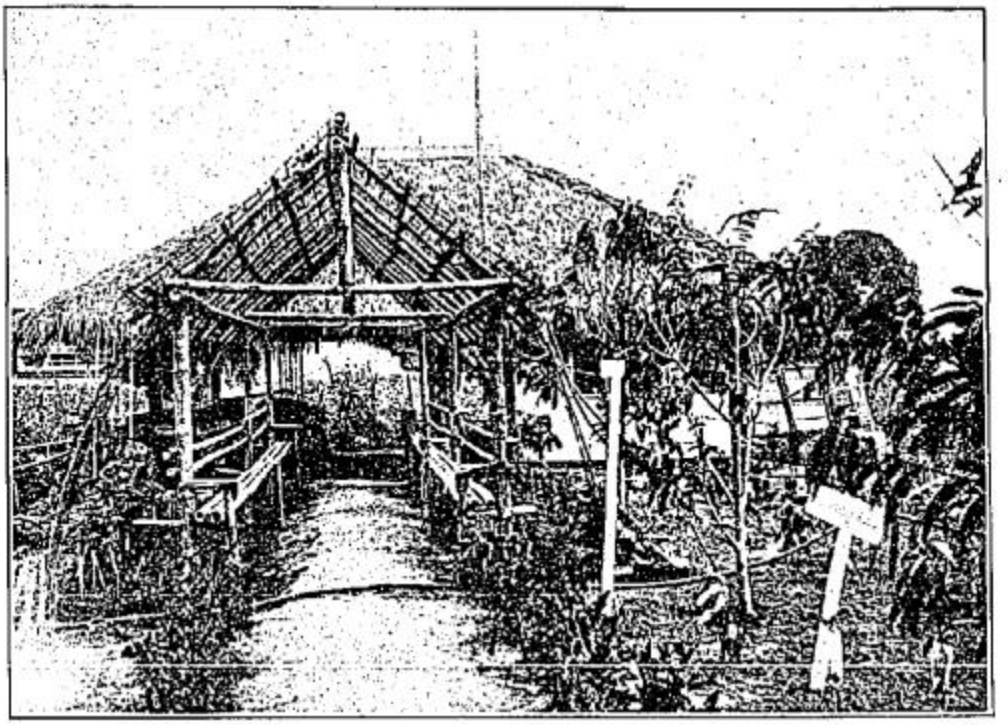
Grafted mangoes have become so popular that the Bureau has received more requests than it can supply although many people have already been supplied with. As many grafted and budded plants as possible have been raised by our stations but the demand far exceeds the supply and, therefore, planters taking an interest in this matter were encouraged to establish private nurseries under the supervision of extension agents to produce their own stock and the grafting work will be done right in their plantations later. This is more economical and makes it possible for anybody to raise the desired number of grafted plants at very little cost. As a whole, the interest taken into the growing of mangoes especially the grafted and budded ones now is very great and many well-to-do and influential men other than those mentioned above have solicited the help of the Bureau.

The campaign on citrus has likewise been intensive and numerous stocks have been prepared both in our stations and provincial nurseries as well as in private nurseries. The scions of mangoes and citrus used for budding work were taken from the best varieties.

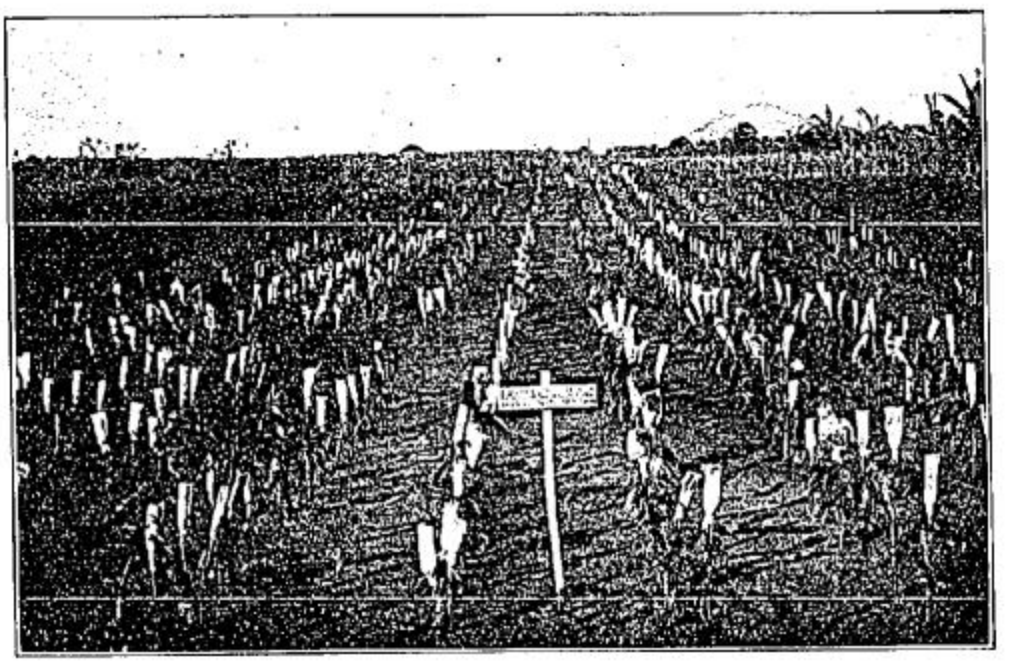
Our campaign in extended coffee growing has also been responded to very enthusiastically by the farmers of Cavite, Batangas, Laguna, and Rizal. Ninety-five thousand, six hundred six coffee seedlings have been planted throughout the district covered by the extension agents.

As a whole the campaign for horticultural improvement has received the full coöperation of the people and the efforts of our agents in this direction have been quite fully justified.

Provincial and municipal nurseries.—The demand for fruit trees seedling throughout the Philippine Islands has always been great. The present means of the Insular Government to meet that demand has always been inadequate in spite of the present arrangement to have all Insular or municipal nurseries and stations in Cebu, Iloilo, Lipa, Santa Cruz, Santa Barbara, San Pablo, Malolos, and Singalong to produce enough seedlings of fruit trees to meet the demand. In view of this, efforts are



(a) A view of the plant shed of Santa Cruz Provincial Nursery



(b) Grafted young carabao mango plants at Lipa Provincial Nursery, Batangas

made to encourage the stablishment of more provincial nurseries and if possible to have one in every province. Provincial as well as municipal officials are being interested in giving financial support to do this. As a result, there are now 6 provincial nurseries and 15 municipal nurseries. The Province of La Union alone has 12 municipal and 1 provincial nurseries and Batangas Province has 2 municipal nurseries and Laguna has 1 municipal and 1 provincial nurseries.

Total number of horticultural plants undistributed in the provincial and municipal nurseries (for 1924)	18,642
Total number of horticultural plants still in private nurseries handled by agents	15,074
Total number of coöperators in the planting of fruit trees	121
Total number of municipal nurseries	15
Total number of provincial nurseries	6

NOTE.—The available materials in the different stations or nurseries financed by the Bureau are not included in the above.

Milk industry campaign.—One of the activities conducted by the division this year is the native milk industry campaign. This was carried on in the districts near Manila with the following principal aims:

1. To improve the quality of milk sold to the people in Manila and different towns where milk is sold at present by inducing the milkmen not to adulterate the milk and by waging an educational campaign for the sanitary handling of it,

2. To increase the production of milk by means of proper care and feeds given to the animals, and

3. To encourage the development of the industry in places where there are possibilities for same.

Associations of milk producers were formed in several places, as in Alabang, Muntinglupa, Caloocan, and San Pedro Macati, Rizal; Baliuag and San Rafael, Bulacan; and in San Fernando, Pampanga. In this work big problems were confronted in view of the newness of the business in the idea of the people and opposition on the part of the middlemen who, in most cases exploit the actual producers and who always make strong efforts to discourage the farmers from joining the association as inimical to their (the middlemen's) business. Another main difficulty met in the organization is the fact that animals used for milking purposes are also used for field work and they are scattered about so that the collection of milk early in the morning is very difficult.

The following shows the different amounts of milk handled by each of these associations and their estimated value since the time they began functioning:

Name	Quantity	Value
	Liters	*Pesos*
Alabang Milk Producers' Association	3,87.4	1,535.14
Rizal Farm Mercantile Cooperative Association	1,378	689.00
Pampanga Milk Producers' Association	166,058.7	47,775.07
Tarcam, Bulacan, Milk Producers' Association	17,605	5,776.70
Maasim, San Rafael, Bulacan Milk Producers' Association	30,950	7,415.05

Because of the campaign the quality of the carabao milk sold in Manila has greatly improved although there are always attempts on the part of the native milk dealers or teddlers to market their milk in adulterated form to make big profits. The pure milk was sold in Manila by the agencies for ₱0.15 per "tansan" bottle and ₱0.25 a "beer" bottle. The demand for milk is so great that the agency has hardly enough to meet the demand. A large amount of milk was sold to the employees of the different bureaus and other Government offices. There is no doubt, therefore, that the campaign will put the milk industry on a solid basis and will reduce the importation of canned milk to a great extent.

The regular dairies produce too small an amount to supply the demand for fresh milk in the city, so any amount of carabao's milk produced by the associations can be disposed of in Manila with no trouble and with big profit so that the industry is very promising.

Cheese making.—The manufacture of cheese in the Islands has great possibilities in view of its demand. In places where fresh milk is produced in quantity and where prices are quite cheap part of the milk produced is made into cheese.

There are only few places where cheese making is quite extensively made, namely: Santa Cruz, Laguna, Cebu, Leyte, and Muntinglupa, Rizal, although there are other places where cheese are made in a lesser scale.

In recognition of the great possibilities of cheese and with the view to increasing the local production and the encouragement of industry with the ultimate aim of reducing the importation of cheese and consequently helping local producers, campaign along this line has been started.

An agent who has shown proficiency and interest in the work assigned to him had been sent to Santa Cruz, Laguna, Cebu, and Leyte for the purpose of acquainting himself of the different methods employed in the manufacture. From the knowledge of

this he is expected to evolve a process superior to either of those employed in places visited. At present the agent concerned is on the job perfecting the process for dissemination to other places. The product expected from the combined process should be of superior kind and have longer keeping quality to be of popular acceptance to the customers. A cheese press will be constructed for use in connection with his work.

Poultry and duck industry campaign.—A compaign for the promotion of the poultry and duck industries was also waged by the division this year. Due to the limited personnel, however, the work was started in a few places only; namely, Malolos district, Bulacan; San Juan del Monte and Pateros districts, Rizal; and in Lipa district, Batangas.

Besides the material results obtained the conditions on the poultry farms in the places to which the agents were assigned have been improved. The people were encouraged to adopt improved methods of handling chickens by means of selection of the desirable stocks, strict sanitation, the use of medicine and proper feeding of the animals. In the campaign, proper culling of undesirable stocks either by complete separation from the flock or by caponizing was also taught. From this work definite results have been obtained in that the prevalent local chicken diseases such as chicken cholera, roup, diarrhea, etc., became less prevalent. It has been estimated that an increase of 2 to 10 per cent has been obtained in San Juan del Monte, Rizal, and Malolos, Bulacan districts. In Malolos district, there were produced 10,671 eggs and 1,132 chicks by the different members of the Poultry Association there.

The campaign has been made by means of personal interviews and conferences with farmers to teach them the improved methods. Small and big farmers as well have become interested in this work and as a result 66 coöperators have been obtained. There were also two poultry associations organized in Malolos district and some members, especially the well-to-do ones have already built poultry houses under the supervision of the extension agents.

Only three agents have been regularly assigned to this work although others were able to do some work such as caponizing work and the treatment of the diseased animals and giving advice to the people as regards the sanitary management in their own districts.

During the year there were 860 chickens caponized, 711 treated diseases, and 7 poultry houses built.

Swine industry.—The campaign along this line was waged only in the Jalajala district, Rizal. The object was to rehabilitate the industry of that district which was once very promising. The Jalajala breed of swine, which is very well known in most places in the Islands is disappearing very rapidly, and attempts are being made to revive the industry and improve the breed by crossing the sows with Berkshire boars. The campaign was started by the formation of a coöperative organization of swine producers and a Berkshire boar was supplied by the Bureau for the use of the association in improving the breeds.

During the year there were 42 sows served by the Berkshire boar, 34 of which became pregnant and 6 farrowed during the period covered by this report. In the campaign along this line proper feeding of pigs was taught the people.

Vegetable growing campaign.—Field agents assigned to this project have waged an intensive campaign for an increased production of vegetables. The Manila market is supplied with vegetables locally raised mostly in the Mariquina Valley and in Baguio, Bulacan, Calamba, Silang, and other nearby towns. And some vegetables are grown in the city but still a big amount of canned and fresh vegetables are imported every year. Increased production by selection and proper culture and by growing vegetables that are in great demand to produce importation is the aim of this campaign.

Local producers' coöperative associations have been organized and the members encouraged to increase their hectarage in vegetables and to adopt improved methods of gardening such as clean culture, the use of improved seeds, the eradication and control of pests and disease, etc.

The field agents have done all they could to encourage the establishment of more commercial vegetable gardens as well as home gardens in their respective districts. During the year the agents helped in the improvement of 398 commercial gardens and the establishment of 4,200 home gardens, having a total area of approximately 1,000 hectares.

The main things that may be considered accomplished by our field agents in this work are the additional market days in a week in Calamba which used to have only once a week while in Cagayan the agent has organized rural markets in towns where they had none before and the increased amount of vegetables handled in the markets of Tanauan, Batangas; Baliuag, Bulacan; and San Mateo and Mariquina, Rizal.

STATION WORK

The division has nine stations or nurseries, as follows:

1. Iloilo Demonstration Station, La Paz, Iloilo.
2. Lipa Demonstration Station, Lipa, Batangas.
3. Malolos Demonstration Station, Malolos, Bulacan.
4. San Pablo Lanzon Station, San Pablo, Laguna.
5. Singalong Propagating and Seed Testing Station, Singalong, Malate, Manila.
6. Santa Barbara Demonstration Station, Santa Barbara, Pangasinan.
7. Santa Cruz Demonstration Station, Santa Cruz, Laguna.
8. Tabonoc Demonstration Station, Talisay, Cebu.
9. Sagay Demonstration Station, Logo, Cebu.

These stations have been reorganized this year to care for only the most important economic crops and fruit trees suitable to the locality, the idea being to convert said stations into real nurseries where budded, grafted, and marcotted plants will be grown on a commercial scale for distribution.

SINGALONG PROPAGATING AND SEED TESTING STATION

This station is the center of seed and plant distribution of the Bureau. The work therein along propagation is carried on a large scale and it serves as a sort of school where anybody including fieldmen who need more skill in the different methods of propagation are sent there from time to time to study nursery work and to practice budding and grafting plants. There were also private parties who sent their laborers to this station to learn general nursery work and know how to bud and graft plants successfully. In this station, monthly seed tests of the different varieties of vegetable seeds both of imported and of native origin are made, in order to be sure of their germination before they are distributed to the public.

Although quite a large number of such plant materials have been produced in this station still the demand cannot be supplied. The same work is also done now on a large scale in other stations so the division hopes to be able to fill next year all orders received from the provinces with plants produced in the nearest station.

During the year there were 1,632 mangoes, 79 lanzones grafted, 925 citrus budded. A total of 3,370 of miscellaneous fruit trees of which 2,260 were mangoes, 548 citrus, 336 mabolo, 102 santol, 336 duhat, 50 tamarind, and 98 alpay were transplanted in the nursery flats for stock purposes. Three thousand one hundred forty-nine (3,149) grafted mangoes were distributed.

The following list shows the amount or quantity of the different plants propagated in the station:

Seeds planted	55,773
Seedlings potted	9,205
Seedlings in seedbed	22,317
Balance from 1922–1923 ..... seedlings	24,255
Distributed during the year	15,938
Balance on hand 1923–1924	27,426
Available for 1924	13,377

The following figures show the returns from the station:

Total amount of collection from sales of crops and seedlings grown	₱3,631.42
Value of seeds and seedlings distributed free of charge	1,085.57
Estimated value of seeds and seedlings undistributed for 1924	5,500.00
Total	10,216.99
Expenses of the station for labor during the year 1923	8,118.29
Net income	2,098.70

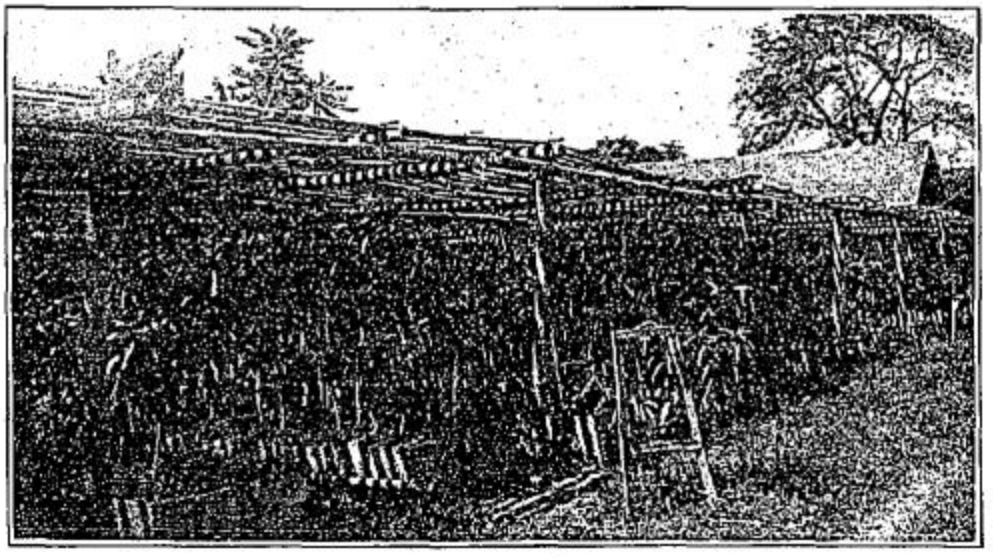
During the year the station made 382 shipments of plant materials to different parts of the Islands besides local deliveries.

LIPA DEMONSTRATION STATION

This station, like other stations, facilitates the distribution of the different plant materials in Batangas and neighboring provinces especially as regards coffee seeds or seedlings either direct from the station or arranged by the agents from the local growers. Budded citrus plants are also distributed in large scale. This is the first time the station has propagated mango of which about 1,000 grafted plants are now ready for distribution.

During the year a total of 33,335 coffee seedlings of different varieties, 298 native mandarin, besides 3,380 sugar-cane points and miscellaneous vegetable seeds, such as radish, lettuce, and mustard were raised and sold at the station. A total or 635 miscellaneous fruit trees of which 130 are coconuts, 427 coffee, 12 grafted mangoes, 32 cacao and 36 budded citrus of different varieties were planted in the demonstration orchard of the station.

The following figures show the returns and expenses of the station:



(*a*) Potted grafted carabao mango plants ready for distribution. Singalong Propagation and Seed Testing Station, Manila

(*b*) Loading grafted mango plants for shipment to the provinces. Singalong Propagation and Seed Testing Station, Manila

(a) Grafted lanzon plants. San Pablo Lanzon Station, Laguna

(b) Marcotted lanzon bearing one year after planting

Total amount of collection from sales of crops and seedlings grown	₱806.79
Value of seeds and seedlings distributed free of charge	2,006.14
Estimated value of crops and seedlings undistributed at the end of the year	2,122.00
Total	4,934.93
Total expenses of the station for 1923	3,099.46
Net income	1,835.47

In this station more attention was given to the propagation of *Excelsa* and *Robusta* varieties of coffee. These two were found suitable to Batangas conditions and what the farmers demand. The Robusta was distributed in the high towns of Batangas and *Excelsa* in the lowland towns. A considerable number of *Liberian* coffee plants were also distributed during the year, but this kind is not so well liked by the people as the two varieties mentioned above.

LA PAZ DEMONSTRATION STATION

The station was reorganized this year to facilitate the distribution of seed and plant materials of the most desirable fruit trees in the southern islands. Attention is concentrated on the production of fruit-tree seedlings although there are other projects that are being carried on such as sugar cane, poultry and swine which also offer big interest to the people of that community.

It is the plan next year to extend the area planted in fruit trees in this station as much as personnel and financial help will permit so that it can supply all requests from Iloilo, Negros and Capiz thus avoiding the shipments of plants from Manila which involves much expenses.

The following figures show the returns and expenses of the station:

Total collection from crops and seeds	₱923.25
Estimated value of seeds and seedlings distributed free of charge	309.70
Estimated value of seedlings undistributed at the end of the year	1,469.50
Total	2,902.45
Total expenses of the station during the year	2,471.65
Net income	430.80

NOTE.—The sum of ₱42.79 from the sales of eggs and chickens and services of the breeding boar are not included in the above figures.

	Square meters
Area planted to crops (sugar cane, different varieties)	17,959
Corn	8,816
Fruit trees	10,011
Bananas	5,747
Papaya	1,200
Watermelon	4,000
Total	47,733 or 4.7733 Ha.

SANTA BARBARA PROVINCIAL DEMONSTRATION STATION

This station has also been reorganized with the view of making it the center of distribution of plant materials in the Pangasinan district. As in other stations the propagation of cacao, corn, coffee, citrus, rice, tobacco, and mangoes especially are made on a big scale.

Poultry raising and swine are also done at the station. Some of the best varieties of Isabela tobacco as well as wrapper varieties have been propagated in the station this year for distribution in the provinces.

The labor employed is paid by the Province of Pangasinan although in the latter part of the year additional help was given by the Bureau in order to put the station in better shape.

The nursery of this station as of the others has been enlarged to take care of the big number of seedlings now being propagated there. Special attention is given to the budding and grafting of seedlings before they are sent out. A total of 8,090 miscellaneous fruit-tree seedlings and 4,354 of miscellaneous vegetable plants were raised in the station during the year; of the fruit trees, 1,845 were distributed. At the end of the year, there are 6,245 fruit trees, mostly coffee, mango, citrus, and rimas. There are also available in the station 9,889 seedlings of the best varieties of tobacco including that of wrapper tobacco.

The following shows the returns and expenses and area under cultivation:

Total amount of collection from sales of crops and seedlings grown	₱94.92
Value of seed and seedlings distributed free of charge	50:31
Estimated value of seed and seedlings available for 1924	2,089.75
Total	2,234.98
Expenses of the station during the year 1923	1,773.61
Net income	461.37

NOTE.—Area of station is 2.8 hectares. Collection of ₱30 from sales of eggs not included in above items. (See report of Animal Husbandry Division.)

AREA PLANTED TO CROPS

	Square meters
Farm crops	24,245
Vegetables	200
Bananas and papayas	300

AREA COVERED BY PROJECTS

Nursery	1,500
Poultry	1,200
Swine	300
Lawn	200
Total	27,945

SAN PABLO LANZON STATION

Like the Santa Barbara Station, this station is not financed by the Bureau but by the municipality of San Pablo, Laguna. The Bureau furnishes, however, the technical assistance. As the name indicates lanzon is the main plant handled for extensive propagation for distribution purposes. Due, however, to the difficulty of obtaining any remarkable success in grafting lanzon, the number of grafted plants produced were not enough to supply the local demand. However, the station is producing as many as possible grafted lanzon in order to reduce the time for the trees to come into bearing and improve the quality of the fruit. A study of the best methods of doing the work to get a good percentage of successes is being made both in that station and the Singalong Propagating and Testing Station. Marcotting is also resorted to although this method of propagation is not very practicable in a large scale. There were 6,786 lanzon seedlings produced in the station during the year besides 481 miscellaneous fruit trees. Of these 1,586 lanzon plants were distributed and 5,200 seedlings left available for distribution next year. Of these distributed 104 were grafted plants. There are also about 200 newly grafted plants in the station which will be available next year.

The following figures show the returns and expenses of the station:

Total collection from crops and seedlings grown	₱115.05
Value of fruit trees and seedlings distributed free of charge	57.90
Estimated value of available seedlings	1,085.45
Total	1,258.40
Total expenses during the year 1923	443.25
Net income	815.15

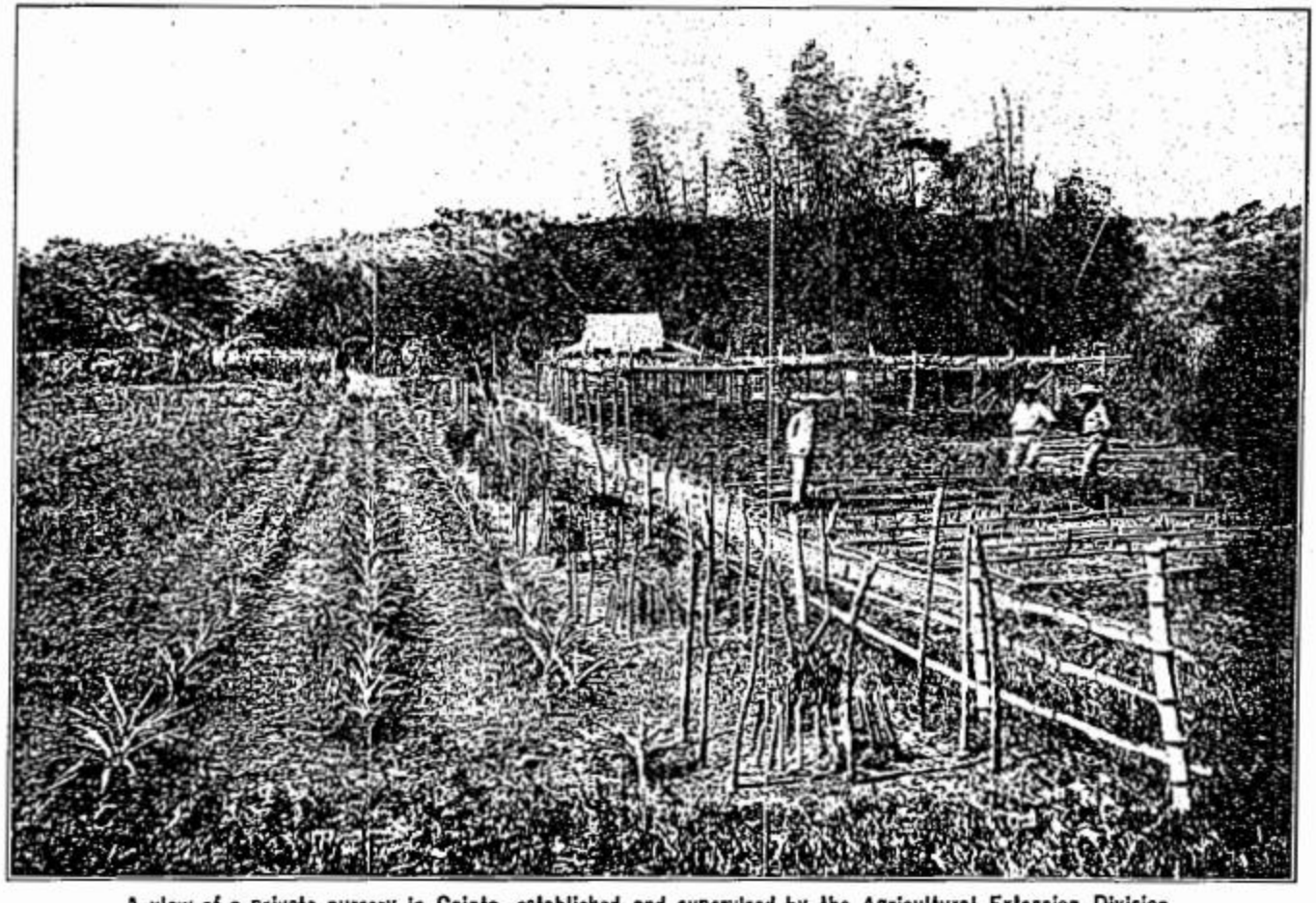
The division has waged a campaign to encourage the coconut owners to utilize the spaces between the trees by planting cacao and coffee besides lanzon. These were found to grow under coconuts with fairly good results and without hurting the coconut trees. In view of this, there is a growing interest on the part of the people of the community to grow coffee and cacao, besides lanzon. And as a result the Lanzon Station needs to be transferred to a larger piece of land where the propagation of these plants can be done in a larger scale. To effect this transfer, the municipality has allotted ₱3,500 for the expenses of the station for 1924. As soon as a new place is selected the work of transferring the station will be started.

SANTA CRUZ DEMONSTRATION STATION

This station has also been reorganized and the propagation of different fruit trees during the year has been on a large scale emphasized. This station is expected to give good results as others as the provincial officials are taking very keen interest in its welfare. Prisoners are used to work in the station. The provincial board has also allotted funds to employ a permanent laborer for the station and an additional appropriation for 1924 will be allotted by the province. This station will be the center of seed and plant distribution to take care of all orders from Laguna especially for coffee, cacao, and lanzon. As the extensive propagation of seedlings has just been started about the middle of the year only 399 coffee plants, 254 papaya, 118 avocado besides several gantas of corn and other seeds were distributed during the last six months of the year but about 5,185 fruit tree seedlings were planted for distribution for the coming year and more are still being propagated.

The following shows the returns and expenses and the area of the station under cultivation:

Collection from sales of crops and seedlings	₱28.00
Estimated value of crops and seedlings distributed free of charge	66.00
Estimated value of crops and seedlings undistributed	800.00
Total	894.00
Total expenses during the year 1923	886.95
Net income	7.05



A view of a private nursery in Cainta, established and supervised by the Agricultural Extension Division

Area under cultivation:

CROPS	Square meters
Hawaiian pineapples	144
Peanuts	840
Cowpeas and cadios	1,800
Momungan camote	1,058
Eggplant and radish	676
Corn	15,000
FRUIT TREES	
Calamonding (for stock)	140
Native pomelo (for stock)	30
Mango (for stock)	800
Coffee	456
Total area	20,946

MALOLOS DEMONSTRATION STATION

This station is financed by the province, but the man in charge is paid by the Bureau. The propagation of mangoes in large scale was given more attention in this section than any other fruit trees—Bulacan being a mango province. There were distributed about 300 grafted mangoes and 896 seedlings are available for distribution at present. Many of these were given to the farmers in Bulacan by the provincial board, some were sold while others were planted in the provincial plaza at Malolos, to replace the acacia trees. The provincial officials are taking much interest in the work of the station especially in the propagation of more mangoes for planting along the provincial roads. The sum of ₱4,000 was allotted by the Province of Bulacan for the expenses of this station next year. Besides mango, the propagation of coffee, cacao, ates, rimas, citrus, etc., was done for distribution purposes. There are 896 seedlings of miscellaneous fruit trees available for distribution at present, a great number of which are grafted plants, and about 4,000 citrus seedlings for stock purposes. There are also 342 pineapple suckers for distribution. The station is also taking care of a Berkshire and a sow for breeding purposes.

The following figures show the returns and expenses of the station:

Total collection from sales of crops and seedlings	₱151.25
Value of seed and plant materials distributed free of charge	132.50
Estimated value of seedlings and crops available for distribution	1,468.15
Total	1,751.90
Total expenses during the year	1,187.36
Net income	564.54

SAGAY AND TABONOC DEMONSTRATION STATIONS

As in the other stations under this division in the Island of Luzon, the nurseries of these stations have been enlarged and the number of fruit trees propagated for distribution purposes increased. More are being planted in order to supply at least in part the demand for fruit trees and for seeds in that region.

These stations are financed by the Province of Cebu and only the technical supervision and the seeds are given by the Bureau. Due to the limited funds, however, only one agricultural extension agent could be assigned to Cebu although an additional one would greatly increase the efficiency of the work inasmuch as the two stations are very far apart. The man in charge, however, is doing all he can to produce as many plants as possible for distribution purposes and special efforts are being made to raise more budded or grafted plants like mangoes and citrus in view of the policy of the Bureau now to distribute as many budded or grafted plants as possible.

During the year a total of 3,634 seedlings of fruit trees and 6,862 miscellaneous vegetables besides 824 packets and 6 gantas of seeds of different kinds were distributed from the station. There were also a total of 1,308 fruit trees of miscellaneous kinds planted permanently in the stations.

The following shows the returns and expenses during the year:

Total collection from sales of crops and seedling grown	₱473.95
Estimated value of plant materials distributed free of charge	1,200.00
Estimated value of products unsold	1,500.00
Total	3,173.95
Total expenses during the year	2,100.00
Net income	1,073.95

There are 9,848 seedlings in the stations mostly coffee, mangoes, and citrus and 5,500 seedlings of miscellaneous vegetables

available for distribution next year. Of the fruit trees, 150 are budded or grafted plants.

SPECIAL PROJECTS

In accordance with the reorganization plan made during the early part of the year the work on abaca, rice, sugar cane, and tobacco was both investigational and extension to obtain more data on these crops for extension work. The Plant Industry Division took charge of the investigation carried on by the agents assigned to said project while the extension work and the general administration project were under this division.

There were 9 agents and assistants assigned to these special projects: 1 in abaca, 4 in rice, 2 in sugar cane, and 2 in tobacco. Although these men have regular assignments as such they also devoted their time to the regular extension work, for instance, in the food production campaign, horticultural work, poultry, etc., giving practical demonstration and advices to the people of their respective districts. They also devoted part of their time to the locust, rinderpest, and anthrax campaigns in coöperation with the local officials and other divisions of the Bureau.

The following is the details of what have been accomplished so far on said assignments:

Abaca industry campaign.—Due to the shortage of personnel only one man was assigned to this project and the work was done only in Albay.

The critical situation of the abaca growers on account of the slump of price of that commodity and dullness of the market has presented a problem to our fieldmen assigned to this project—growers became discourage, abandoned their plantations and planted coconuts and rice instead. Efforts are made to keep them on their plantations and encourage them to use superior varieties and to practice clean culture in their plantations besides renewing old plantations which have proved unprofitable with desirable varieties. Also attempts have been made to stop the practice of harvesting immature stalks (poads system) which practice is detrimental to the industry as a whole on account of the poor quality of fiber produced therefrom. The proper striping of the fiber was also taken up. The formation of farmers' coöperative associations has also been suggested to the growers as a means of improving the industry, as in this way they could get together and adopt measures and practices that will tend to protect the abaca industry.

Rice industry campaign.—The rice campaign this year has been concentrated in Central Luzon and only a limited district has been allotted to each agent.

The drought which prevailed in those provinces before the heading period of the rice crop this season and the typhoon which caused the inundation of extensive rice fields—that district being the granary of the Islands—would have caused a shortage of rice if not some of the fields have been replanted through the activity of the local officials and the field agents. A considerable amount of corn, mongo, root crops, and vegetable seeds was distributed by the Bureau and those seeds were received on time to have damaged fields replanted.

An intensive campaign will be waged in the rice region same as those in other provinces, for the purpose of uniting together the growers to save them from the clutches of usurers who usually deprive them of their legitimate shares of the profit. This might be realized by the organization of rice producers' associations and the encouragement of the construction of Government bonded warehouses where the rice could be stored in by the growers at low charge. The Government can do a great deal for the growers who are in bad need of help, by constructing these warehouses where the farmers can store in their palay as necessary mortgage to get a loan from the Government, paying the legal interest as well as for the storage, until such time as the price of palay is good. The rice farmers generally do not get good price for their product as just after the harvest some time even before that time they sell their palay at a very nominal price as they have no means of getting money somewhere else except from the usurers or rice buyers.

Sugar-cane campaign.—The sugar-cane campaign was carried on in some of the sugar-cane districts of Batangas, Laguna, Iloilo, Pampanga, and Occidental Negros because of our limited personnel.

The extension work on this crop has been carried on also side by side with the investigational, the purpose of which are to improve the present sugar-cane industry by the use of improved varieties, proper cultual methods, and eradication of pests and diseases, etc.

Great interest has been shown by many planters in the use of introduced varieties of cane proved to be higly productive and resistant to diseases in other places. Numerous requests for cuttings of these varieties have been received but only a limited amount could be supplied. Effort was made to distribute those tried varieties to as many people as possible so that the Bureau can get more information as to behavior and results of these varieties when planted in other places. This policy is strictly adhered to whenever possible.

As the Bureau could not supply all requests for cane materials received due to the limited amount of material available for distribution, the extension work has been carried on to the extent of connecting certain growers producing the best varieties in quantity, with those that need the material.

Tobacco industry campaign.—The campaign along this line was carried on only in the Cagayan Valley. Two extension agents were assigned to the extension and investigational work on tobacco as well as in the organization of coöperative tobacco producers' associations in that valley.

The tobacco problem in the Cagayan Valley in relation to the native growers is quite a big one and an attempt has been made to solve it by the formation of tobacco growers' associations in places where such were possible. Preliminary work has already been started. One association has been partly formed in Nemmatan, Jones, Isabela. There has been no appreciable work accomplished by this association so far, however, except that in connection with the planting of introduced varieties and better methods of cultivating and curing tobacco to which the farmers have shown great interest. In the organization of producers' associations, the main aims are to help the producers, especially small ones to get legitimate returns from their labor. The agents have also given advice as regards the use of improved seeds, clean culture, etc. The Bureau has distributed in the valley seed tobacco of the varieties Florida–Sumatra, Dammao Middle Broadleaf, Anipa–Sumatra, Spada–Dammao, Fisu, and a special wrapper variety which are proved to be the best varieties of tobacco.

SOME RESULTS OF THE CAMPAIGNS WAGED DURING THE YEAR

The influence that the fieldmen have exerted in their district may be classified as: (1) educational and (2) financial. The results from the educational though if estimated in money are already considerable.

As to the financial side, the figures from the horticultural campaign alone—726,090 fruit trees valued approximately ₱500,000 planted in the districts covered by our fieldmen—show that they have done much for the benefit of the country. The profit obtained from the poultry and swine campaigns can very safely be put at ₱2,000 and from milk and vegetable campaigns at ₱5,000. These values, of course, do not include the advices and helps made by the field agents, the value of which cannot be estimated.

SEED AND PLANT DISTRIBUTION

The distribution of seeds and plant materials is one of the main activities of this division. For several reasons the practice of loaning seeds was discontinued last year but distribution of seed and plant materials free of charge, to a limited extent, has been made though every effort is always exerted to sell plant materials to all farmers who can afford to pay in order to raise revenues for the Government. This division always tries to give timely help in the way of seeds either direct or through its extension agents, especially to those municipalities hit by typhoon where relief work has to be done.

This division alone has distributed during the year 39,150 packets and 1,719.10 kilos of vegetables and miscellaneous seeds valued at ₱5,256.60 were distributed. Of these 27,730 packets and 1,501.95 kilos valued at ₱4,116.40 were given free of charge, mostly for educational, coöperative, and relief works.

Of fruit trees and other plants there were distributed 18,320 plants valued at ₱5,545. Of these 14,204 plants valued at ₱4,566.15 were sold, and 4,119 plants valued at ₱978.45 were distributed free of charge. Of the plants distributed there were 4,902 budded or grafted plants valued at ₱2,899.96 and 91 marcotted valued at ₱532.

There were also distributed miscellaneous plant materials, consisting principally of sugar cane, forage grasses, and some ornamental plants valued at ₱246.59. The plants distributed are either produced in our Singalong Propagating and Testing Station and Lipa Demonstration Station or in the Batangas, La Carlota, or Lamao Experiment Stations of the Plant Industry Division.

RECOMMENDATIONS

For increased efficiency of the service the following recommendations are hereby submitted for consideration:

1. In view of the demand for the services of the field agents in the provinces—personal and written requests for them have been made by Governors, Representatives, Senators, and prominent farmers—and in order that the division can cover more provinces the field force of the division should be increased but only graduates of the colleges of agriculture with enough experience should be taken into service.

2. Those who have rendered satisfactory service should received promotion. There are at present a number of extension agents in this division who have rendered faithful and efficient service for at least five years without receiving increase in pay.

Unless these men are given what they deserve, this Bureau is likely to lose them and even if not cannot expect the efficiency from them it could if they were encouraged by better pay. Furthermore, the inadequate salaries they are receiving do not permit them to associate socially with the local officials which association is essential for the proper conduct of their work.

FIBER DIVISION

PERSONNEL

At the beginning of the fiscal year covered by the present report the personnel of the Fiber Division consisted of 1 chief, 1 assistant chief, 3 supervising fiber inspectors, 17 fiber inspectors, 26 assistant fiber inspectors, and 5 clerks. The above number of employees remained constant throughout the year with the addition of 1 permanent and 2 temporary fiber inspectors appointed during the year.

Notwithstanding the fact that the Fiber Division was handicapped for lack of personnel to supervise and inspect the enormous quantity of fiber produced in 1923, the division as a whole, functioned with remarkable degree of efficiency in maintaining the official standard for the classification of the different kinds of fibers which were graded and baled during the year in the various grading stations throughout the fiber producing provinces.

ACTIVITIES

During the year some of the assistant fiber inspectors were detailed on locust campaign and others were employed in the fiber producing districts to instruct the fiber producers in improving their methods in extracting and preparing their fiber for the market. Other assistant fiber inspectors were detailed to make scientific strength tests, and 10,320 strength tests were made of fiber from different districts to determine the tensile strength of the different Government grades of fiber in order to have accurate data of the average tensile strengh for each Government grade of the different fibers produced in each district.

FIBER GRADING AND INSPECTION

In enforcing the provisions of the Fiber Law it was necessary to station fiber inspectors in two additional ports of exportation; namely, Zamboanga and Davao. Opening these new export stations saved the fiber producers in those regions the enormous amount of freight which they would have had to pay had the fiber been shipped to Manila or Cebu instead of having

been exported directly from the above mentioned ports. Notwithstanding the fact that during the year fiber inspectors inspected 1,666,605 bales of fiber no serious complaints were received about the classification of the bales certified by the different Government inspectors throughout the fiber producing districts.

Since our report regarding complaints from London was made recent trade letters which we have received seem to strengthen the opinion expressed in that report that the complaints were not justified by fact and were made for ulterior motives. The following is an extract of a letter from London dated November 8, 1923:

> It is no use spinners saying that trade is not good, THE FACT THAT MORE MANILA THAN EVER KNOWN WILL GO INTO ACTUAL CONSUMPTION, and if the trade would only realize that Manila hemp of the lower grades is cheap, then the sooner they buy for stock the better for the future of home trade. PRACTICALLY ONLY ONE FIBER IS BEING USED IN THE UNITED KINGDOM, AND THAT IS MANILA HEMP, and if spinners would help the dealer in the serious efforts being made by some of the merchants to do away with the Government grading in view of the very bad quality and irregular grading which is going on in the Philippines, the better for the trade.
>
> Government interference always results "in minimum results and maximum pay and bad work."
>
> Let the best shipper pack the best hemp he can get under his own house marks and he will get his *quid pro quo*. (Our insert: In other words, let them steal as much as they can from the producer.)
>
> If the spinners will not agree to help to do away with grading with a modified improvement on the question of arbitrations in London, the manufacturer cannot expect assistance from the shippers, AS BALERS CANNOT DO MORE THAN DELIVER "J" GRADING AGAINST "J." Let us go back to "fair current" quality, fibre, strength, count, AND THE CONSUMPTION OF MANILA WILL INCREASE.

It can be easily seen from the statement "AS BALERS CANNOT DO MORE THAN DELIVER "J" GRADING AGAINST "J" that the London dealers want to be in a position to buy "J" grade fiber but have an "I" grade or higher grade delivered to them. In other words, they seem to want to buy "I" or some other higher grade fiber at the price of "J" grade and are not content with the enforcement of the Fiber Law in such a way as to assure them that when as they express it "The manufacture cannot expect assistance from the shippers, AS BALERS CANNOT DO MORE THAN DELIVER "J" GRADING AGAINST "J," as long as the Fiber Law continued in force." Attention is also called to the following statements: "The fact is that more Manila than ever known will

go into actual consumption." "Practically only one fiber is being used in the United Kingdom, and that is Manila hemp." Then the following "Let us go back to 'fair current' quality, fibre, strength, court, and the consumption of Manila will increase." Under date of London, December 13, 1923, we quote the following extracts from a London trade letter:

> Ropemakers are being lulled into a sense of security with the idea that there are huge quantities of unsold hemp afloat.
>
> The bargain counter, however, is empty, as there are no speculators holding stocks and there are no outside operators in the trade. Consequently, with the low stocks in London and Liverpool, bargains, if any, that come along are quickly picked up. The official stocks here are as small as they have ever been, and although one hears of occasional "distress" parcels going cheaply, they are exceedingly scarce and buyers are eagerly waiting to secure them. The quantity of hemp afloat appears to be large when shown in bales but if reduced into tons it does not appear at all heavy. We believe that fully 70 per cent of the hemp shipped has found buyers before it left Manila, and the balance is usually disposed of before the vessels arrive. A strong effort is being made to get the trade on to a proper quality basis. Government grading has outlived itself, and surely English firms are capable of judging what is right without having a tag put upon the bales telling them what it should be, but rarely is.

The following table gives the number of bales of abaca, canton, and pacol fiber certified from 1915 to 1923, inclusive and the percentage of weak and damaged fiber segregated from normal fiber each year:

Year	Total bales of abaca fiber certified as damaged of weak fiber	Total bales of abaca fiber certified as normal	Percentage
1915	1,011,336	8,200	0.8
1916	1,174,663	14,310	1.2
1917	1,291,851	14,461	1.1
1918	1,321,479	11,700	.9
1919	1,166,486	13,710	1.2
1920	1,051,601	14,591	1.4
1921	692,822	15,561	2.2
1922	1,209,088	40,619	3.4
1923	1,454,300	60,650	4.2

GRADING STATIONS AND ESTABLISHMENTS

During the year the Fiber Division maintained 33 fiber grading stations, an increase of 12 fiber grading stations over the previous year, with a total of 145 fiber grading establishments or an increase of 8 grading establishments as compared with the previous year.

TABLE XXVII.—*Giving the province, location, and the number of fiber grading establishment by classes*

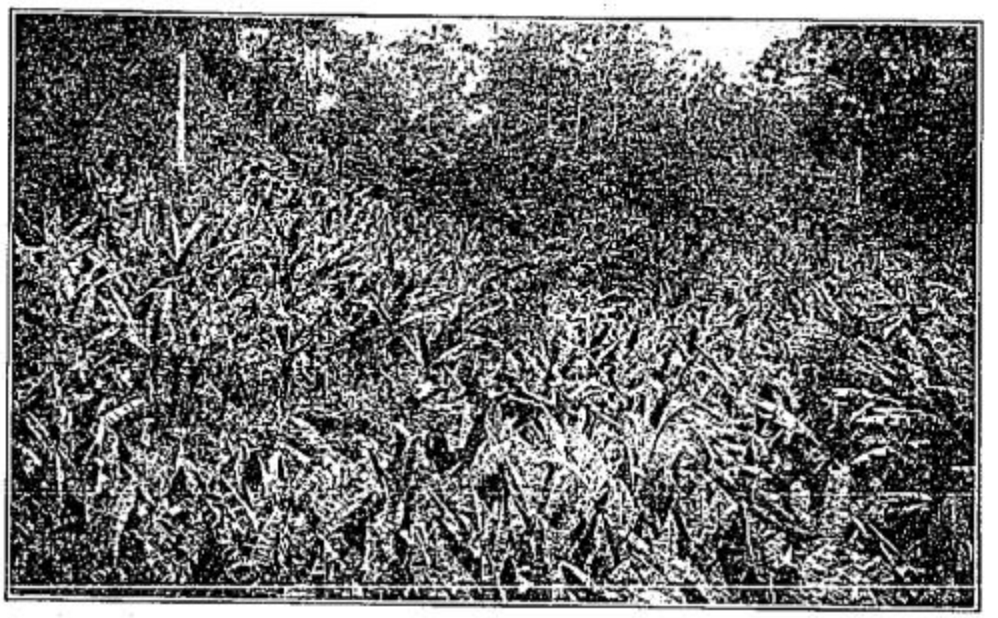
Province	Grading station	Number of grading establishments by class						Total
		1	2	3	4	5	6	
Manila	Manila	2	3	2	4	2	1	26
Cebu	Cebu	5			3	2	5	12
Leyte	Tacloban		1		2	1		4
Do	Carigara		1		2	1		4
Do	Maasin					1		1
Do	Malitbog	1						1
Do	Baybay		1					1
Do	Palompon		1					1
Samar	Calbayog				3	1	1	5
Albay	Legaspi			1	2	5	3	11
Samar	Catbalogan				1	1	1	3
Albay	Tabaco		1	1	2	3	10	17
Do	Ligao				1		2	3
Catanduanes	Virac					2	2	4
Camarines Norte	Daet				1	1	1	3
Camarines Sur	San Jose (Sabang)					2	5	7
Do	Sagnay (Nato)				1	1		2
Do	Naga					1	5	6
Do	Iriga					1	1	2
Sorsogon	Sorsogon			1	2			3
Do	Donsol						1	1
Do	Casiguran			1	1			2
Do	Gubat					3	1	4
Do	Bulan				2			2
Masbate	Masbate						1	1
Surigao	Surigao				2		1	3
Davao	Davao		3	1		1	2	7
Do	Malita					1		1
Do	Talomo			1			1	2
Zamboanga	Zamboanga	1					1	2
Misamis	Cagayan					1		1
Tayabas	Mauban						2	2
Ilocos Sur	Vigan						1	1
Total		9	11	8	24	31	62	145

As a consequence of the shortage of personnel in the Fiber Division it was only possible to maintain fiber inspectors part of the time at 14 grading stations, and assistants acting as fiber inspectors at 2 grading stations and 7 assistant fiber inspectors at 7 grading stations, leaving 10 grading stations with neither fiber inspectors nor assistant fiber inspectors.

As a result of the shortage of employees to cover all the provincial grading stations a considerable number of bales of fiber had to be inspected in Manila, Cebu, or elsewhere which entailed a large and unnecessary expense to the provincial grader.

The following table shows a steady increase in the number of fiber grading establishments from 1915 to 1923, inclusive:

Year	No. of establishments
1915	89
1916	97
1917	101
1918	113
1919	117
1920	120
1921	125
1922	137
1923	145



(a) A view of an abaca plantation in Albay province

(b) Clearing a plantation preparatory to stripping. Albay province

Since the government classification went into effect on January 1, 1915, the number of fiber grading establishments has gradually increased. The increase in the number of grading establishments has been principally due to the simplification of the grading of fiber under the government standards making it possible for other fiber merchants to maintain their own grading and baling establishments, thereby increasing competition and giving the fiber producers a better opportunity to advantageously dispose of their product.

During the year the revenue collected by the Fiber division was more than ₱188,660 divided as follows:

Inspection fees—	
Abaca (cordage grades)	₱143,242.10
Abaca (tagal braid)	316.20
Maguey (retted)	18,865.10
Maguey (machine cleaned)	564.30
Sisal (retted)	278.20
Sisal (machine cleaned)	59.30
Canton	2,130.40
Pacol	7.50
Rejected fiber (all kinds)	1,147.40
Fiber grading permits	22,000.00
Official samples sold (amount not available)	0.00
Total	188,660.50

FIBER INSPECTION RECORD

The following table shows comparative statements of the total number of bales of fiber graded, baled, and inspected by the Government fiber inspectors in 1922 and 1923.

TABLE XXIX

Kind of fiber	1922	1923	Increased or (decrease)
Abaca (fiber)	1,209,088	1,452,421	223,333
Abaca (tagal braid)	9,199	3,162	(6,037)
Maguey (retted)	155,532	188,651	33,117
Maguey (machine cleaned)	9,592	5,643	(3,949)
Sisal (retted)	1,784	2,782	998
Sisal (machine cleaned)	1,307	593	(714)
Canton	16,137	21,804	5,667
Pacol	108	75	(33)

PLANT INDUSTRY DIVISION

ACTIVITIES

1. Plant and seed selection.
2. Variety tests of different crops.
3. Acclimatization tests.
4. Fertilizer tests.
5. Hybridization work.

6. Cultural experiments.
7. Longevity tests of seeds.
8. Preservation and storage of plant and seed materials.
9. Crop rotation experiments.
10. Experiments on the production of tobacco wrapper.
11. Seed production and plant propagation.
12. Plant and seed introduction and dissemination.
13. Agricultural exploration and investigation.
14. Coöperative experimentation.
15. Preparation of materials for publication.

The following table shows a comparative summary of activities of the division:

Activities	1922	1923
Number of stations	12	9
Number of projects	17	39
Number of experimental tests and field investigations carried	147	432
Number of cooperative experimenters	304	587
Number of press items sent out for publication	20	48
Number of circulars published	8	10
Number of bulletins published	2	0
Number of B. A. forms prepared	51	69

ORGANIZATION

The division is divided into two main sections; namely, the Agronomy and Horticulture.

PERSONNEL

During the early part of the year there were in all 41 employees of the Plant Industry Division. At the end of the year there were 40, a decrease of 2.5 per cent.

STATUS OF PERSONNEL

	Number of employees			
	Technical	Clerks	Emergency	Total
Employees at the beginning of the year	33	2	6	41
New appointees during the year	1			1
Transferred from other divisions	2	1		3
Resignations during the year	1	1	2	4
Transferred to other divisions	2			2
Messenger				1
Employees at the end of the year	33	2	4	40
Increase or decrease of personnel	(0)	(0)	(2)	(2)

PERMANENT IMPROVEMENTS

The Pikit Tobacco Station completed one new building and one culvert this year. Two cement culverts were constructed and the underground fruit storage chamber was reconstructed into cement structure at the Tanauan Citrus Station.

This year a special allotment of ₱2,358.72 was secured repair of buildings, propagation shed and fences at the Experiment Station. The work is still in progress.

EXPERIMENT STATIONS

During the year the Abaca Trial Station was established at Binogsakan, Guinobatan, Albay. That station began operation on September 25.

The list of the stations of the Plant Division is as follows:

1. Alabang Rice Station, Alabang, Rizal.
2. La Carlota Experiment Station, La Carlota, Occidental Negros.
3. Lamao Experimental Station, Lamao, Bataan.
4. Dammao Tobacco Station, Dammao, Gamu, Isabela.
5. Pikit Tobacco Station, Pikit, Cotabato.
6. Tanauan Citrus Station, Tanauan, Batangas.
7. Rosales Rice Substation, Rosales, Pangasinan.
8. Bontoc Semi-temperate Fruit Substation, Bontoc, Mountain Province.
9. Abaca Trial Station, Binogsakan, Guinobatan, Albay.

These were inspected as often as possible; and the station men were called to the Central Office for conference, when necessary.

AGRONOMY

LOWLAND RICE

Acclimatization test.—The Alabang Rice Station has received from Experimental Farm Station, Echo, Manchuria, China three seed samples of rice, named Hokkaido, Handjonza and Korean Glutinous, respectively. With several other samples, these were planted in February. The resulting plants were dwarf and prematured.

Better growth was made by the rices from Madagascar and from Persia, which had been under acclimatization test for some time. The most promising ones, however, are the Vato and Lava Sumatra rices, from Madagascar.

At the Rosales Rice Substation a number of native varieties were subjected to dry season acclimatization work, including some recently acquired "palagad" rices.

General variety test.—One hundred sixty-four named varieties were grown at the Alabang Rice Station and 150 varieties at Rosales Rice Substation, making a total of 314 varieties, exclusive of upland rice. A number of decidedly poor yielding varieties were dropped from the test at Alabang, but on the other hand certain new varieties had been added.

About 80 per cent of the Rosales planting was destroyed by the floods in November. At Alabang the October drought was bad enough on the crop and the situation was aggravated by the very heavy rain which fell in November. It was estimated that the reduction of the crop with the known high yielding varieties in the latter station was 30 per cent.

Special variety test.—The multiplication test was run at Alabang, to raise seed material for the Bureau coöperators, and to enable the station concerned to judge the merits of the choice varieties when planted in a more or less commercial way. Sixty varieties were planted for this purpose.

A partial list of these rices is presented below, merely to show relations, the yields being in all cases below normal.

Variety name	Yield in kilos per hectare
Quinatia I	2,369
Lamio	1,774
Biñan	1,719
Manacasar	1,684
Inosema	1,572
Macan Lamio	1,565
Lad-as	1,364
Barangbang	1,200
Manaban-ac	1,051
Macan Santa Rosa	1,045
Piniling Daniel	1,030
Siamese "A"	1,011
Inachupal I	980
Minalabon	1,163

Irrigation experiments: Submergence test.—Irrigation experiments carried on during the last three seasons at Alabang Rice Station, were directed mainly on the determination of the total amount of irrigation and rain water necessary to mature a normal rice crop. This amount, according to the results, is equivalent to a discharge of water ranging from 1.1 to 1.5 second liters per hectare throughout the submergence period. The experiments were conducted on a flat, close 16-diked, old paddy land underlaid with an impervious substratum, and the distribution of water thereon was under perfect control. Initial flooding was given to raise the water level up to a height of 5 centimeters and the subsequent submergence water had been kept within that height.

The work herein recorded was primarily an attempt at studying the means by which a future method of experimenting may be devised. In a series of six plots various depths of submergence were tried; that is, in Plot No. 1 water was supplied to keep the soil just wet or saturated, as can be possibly done;

in Plot No. 2 the submergence depth was marked at 5 centimeters; in Plot No. 3, at 10 centimeters; in Plot No. 4, at 15 centimeters; in Plot No. 5, at 20 centimeters; and in Plot No. 6, the supply was fluctuating.

Each of these plots contained a planting area of one are, 10 meters square, bounded by a single dike, measuring 25 to 30 centimeters wide at the base and 30 to 40 centimeters high. The whole system was connected on the more elevated situation, with the irrigation canal, and a drainage ditch on the opposite side.

Conner rice was planted in the plots August 14, 1923. At that time seedlings were 50 days old. It was planted in hills containing 3 to 7 plants each, spacing the hills approximately 20 centimeters each way.

The plots were allowed to remain in the mud state until August 21, when a trial submergence in Plots 2, 3, 4, 5, and 6 was started. Adjustment of the water was next made and in the afternoon of August 24, the first readings were recorded. Two readings had been taken daily; that is, one at 2 p. m. and the other at 6 a. m. on the next day, the two being considered as pertaining to the first day.

The period over which the submergence had been carried on, extended from August 24, 1923, the date of first reading to November 4, inclusive or 73 days. At this time the plant was in dough stage, as Conner is an early maturing variety. All surface water was drawn out from every one of the submerged plot. Where water had stood deep as in Plots 3, 4, and 5, the resulting mud-ground was much softer, thinner, as compared with other plots submerged to lesser depths, and this fact has given rise to a relative difference in the drying capacity of the plots beds as well as the maturity and lodging of the resulting crops.

The following tables show the depths of water applied, or submergence depths from consolidated morning and afternoon readings, which ran fairly uniform.

Table showing the average of 73 readings for each of the series or the readings taken through the extent of the experiment.

(IN CENTIMETERS)

Plot No.—	2 p. m.	6 a. m.
1	0.4	0.4
2	5.7	5.7
3	10.6	10.6
4	15.4	15.2
5	20.00	19.2

It is thus seen that with exception of Plot 5 no difference resulted between the 2 o'clock readings and the 6 o'clock readings. The lower water height registered for Plot 5 as observed at 6 o'clock was due in a great measure to the difficulty of controlling the water in that plot.

Just about two weeks from the first flooding, September 10, the young plants were attacked by the rice case worm, *Nymphula depuntalis*. The insect cuts off a good portion of the blades and spends its pupal stage in rolled up portions of the blade. The damage was most severe in Plot 5 where water was flooded 20 centimeters deep, Plot 4 was attacked badly enough though not so severe as Plot 5. In Plots 2 and 3, where submergence water was shallower, the injury by the insect was relatively slight. The condition of Plot 1, kept under moist or thin sheet of water, might well pass as normal. The severity of the insect attack increased for some time and at such a rate that on September 18, all plants in Plot 5 and a good percentage of those in Plot 4, were completely defoliated. Changing of the water did not help the situation. The attack was made in the form of an outbreak and the fact that it was particularly intense on the deeply submerged plots leads one to believe that the activity of the insect was associated with the depth of water.

There was no way of ascertaining the extent of the damage done, consequently the yields of plots given below are not to be considered relative and consistent experimental data. The maximum damage was about 27 per cent, when it is assured that yield of Plot 1, to be normal or nearly so and the difference between this yield of Plot 1 and that of Plot 5, which is 370 kilos to the hectare, to be the loss.

Hectare yields were directly computed from actual plot yields.

(In centimeter)

Plot No.—	Submergence depth	Yield per hectare
		Kilos
1	Just moist	1,750
2	5	1,100
3	10	1,200
4	15	1,120
5	20	400
6	Fluctuating	980

Plot 1 which was only moist, was overrun by the common rice weeds largely by *Eleocharis capitata* and *Cyperus difformis*. It was thus necessary to weed this plot out. A thinner stand of weeds was also evident in Plot 2, 5-centimeter depth of water, and some hand cleaning was given. These weeds, however, were

not noticeable in the deeply submerged plots. Plots 4 and 5, indicated that deep submergence of 15 to 20 centimeters was effective in controlling that class of weeds.

The deep submergence in Plots 4 and 5 had caused the maturing period to proceed slowly, as a result of the wet condition of the ground obtaining for over a week after the water was withdrawn from the plots. Plot 1 matured November 15, exactly 179 days counting from the date the seed was set to sprout, whereas Plot 5 matured November 23, or 8 days longer. This relationship was also noticed in other plots. In Plots 4 and 5 the plant fell down to the ground, which was not the case in Plots 1 and 2 and in Plot 6.

Water losses in rice irrigation.—It was aimed by this preliminary experiment to measure the losses of water from evaporation, transpiration, seepage and percolation in rice irrigation.

The main experiment was conducted in a paddy at the Alabang Rice Station whose inside dimensions are 20 by 10 meters. The soil is of clay type containing 18 per cent clay and 32 per cent fine silt. Seedlings of the rice "Conner" were planted to this. A week time was allowed to elapse, and then the land was submerged to about 8 centimeters deep. The rating tanks were located near the experimental paddy. No. O tank was used to measure the free surface evaporation; Nos. 1 and 2 were planted at the same time in the paddy with the same variety, and gave the evapo-transpiration measurements. Five evaporating cans were distributed in the paddy for taking readings on shaded surface evaporation. These cans are 34.5 centimeters long, 23.7 centimeters wide and 18 centimeters deep, each. Each of the tanks has a depth of 9 1centimeters and a diameter of 183 centimeters clear. These tanks were sunk one near the other in a paddy, with 30 centimeters of their brim being exposed. The small cans were securely fastened to the ground so that submergence water in the experimental paddy just coincided with the level of the water contained in the cans. The same depth of water was kept in the two planted tanks as in the experimental paddy. The depth of water in the cans varied from 5 to 8 centimeters. As in the paddy the plants in the tanks were not in hills of 3 to 5 plants each and the distancing was opproximately 20 centimeters.

The weather was very much out of the ordinary this year. A long droughty spell occurred in October. A stormy weather followed in November, registering on November 18 the heaviest amount of rainfall for many years (121 millimeters in 24 hours).

These brisk changes of the weather had affected the experiment greatly especially as concerned precipitation as a factor involved in calculating evaportion and others.

The results had been much upset by the insect outbreak described in the submergence test which brought about a complete defoliation of the plants in the experimental paddy.

The experiment will be repeated.

Dry season crops—Palagad.—The planting of six varieties, was done in February each variety occupying an area of about 200 square meters, at Alabang. As in the last two years, Sipot has again occupied the first place in production, with Mangasa and Dinagat taking the second and third places, respectively. The results from Rosales show Sipot also in the lead, then come, Binicol and Sanglay Puti. Saigorot and Lampadan are the two most promising representatives of the bearded class to do well in dry season planting.

TABLE XXX.—*Yields and the maturing periods*

Variety name	Maturing period in days		Yield per hectare in kilos	
	Alabang	Rosales	Alabang	Rosales
Sipot	140	137	2,221	3,094
Mangasa	145	128	1,983	1,400
Dinagat	140	123	1,401	1,095
Binicol	165	.....	1,195	1,958
Magsanglay	135	130	1,078	1,431
Lava	140	133	919	1,887

The Kaawa, Inita, and Lampadan, grown in Rosales, alone, made also a very good crop. Possessing an awned grain, the Lampadan variety is looked for to be the most adapted where protection from the birds is a necessity.

It is very probable that Binicol, a popular table rice would do better if planted broadcast so as to remedy its defect of producing uneven stand.

Study of weeds.—The study of rice weeds with a view to their control is a complicated matter, on account of the vast number of them and the variability with which some of them appear in nature.

The description which follows refers to a number of these plants, which had come to the notice of the Bureau during a brief period of one year.

Eleocharis capitata (Cyp.).—This plant of the Balangot family, is one of the most troublesome weeds in rice paddies. It thrives best in shallow water, forming a thick tufted cover and is among the first to appear in the field. The stem are short hardly attaining more than 30 centimeters

in height. An infested field is easily got ridden of this weed by hand cleaning. The plant is allowed to grow for some time but before flowering, which takes place early with this species, it is pulled out and buried into the mud. In poorly worked soil or where drainage stand is thin this grass is liable to require more than one weeding. It is probably controlable by submergence.

Scirpus erectus (Cyp.).—A widely distributed plant. In paddy land where water does not stand too deep for any length of time, it may appear all the year round. Though less spontaneous than *Eleocharis capitata* with which it is generally found. *S. erectus* is also able to grow rapidly and form a thick matting 30 to 50 centimeters thick. It is one of the worse weeds a rice farmer has to contend with.

Cyperus difformis (Cyp.).—An umbrella plant very common in the rice paddy. Grows most abundantly in unplanted seed beds and wet fallowed grounds near rice fields. It is also found in water ways and excavations along the border of the field. The plant has a wide growing season. In October and November, long after rice has passed the seedling stage, the weed may still feed in close run with the cultivated plant. It is able to grow to a great height.

Sphenoclea zeylanica (Campanulaceae).—It is an early grower, semi-equatic herb, quite widely distributed. It frequents open places and alleys between rice plots. Generally short, but it sometimes gets as high as 50 and even 60 centimeters. Spikes are green. Lobed capsules fall to the ground at intervals. Brown when ripe.

Fimbristylis miliaceae (Cyp.).—Sometimes called by the Tagalog "Gumi gumi"; in Pangasinan it is known as "Sirao-sirao." Widely distributed. During off season for rice the field may be overrun with this weed. Some farmers regard it troublesome not so much as a weed, but for obstructing the working of the plow in the preparation of the land. May grow in considerable number on dikes, dry seed beds and waste places. Inside the paddies the growth hardly ever attains a proportion which would require weeding.

Ipomoea reptans (Convolvulaceae).—The familar cancong. Even before the field is planted to rice crop in July or August, individual plants spring up from the newly cleaned dikes and begin to descend to the field. They appear later in submerged paddies but at widely separated points. The propagation is done by runners or vines, which trail on the mud and strike roots from certain joints, giving rise to new individuals. On deeply submerged field the vines can hang floating, where most other weeds do not thrive. Long vines measure several meters. It would not be hard to rid the field of cancong if vines are removed from year to year.

(Unidentified Sp.).—The herb is thickly foliated. The stem sharply 4-angled. Leaves lanceolate, with distinct parallel veins. Flowers small, yellow. The plant is rampant over large areas of stubble rice lands in Tarlac and Nueva Ecija provinces, and is probably of wide occurence during the dry months in the Philippines. At the Alabang Rice Station, the plant in full height is over 1 meter. The growth in cultivated fields is circumscribed.

Monochoria vaginalis (Pontederiaceas).—Calaboa (Tag.) Bil-logot (Pang.). Belongs to the pondweed family. This beautiful lily-like plant often grows in stagnant water of the paddies. It is rarely met with in

shallow irrigated field. The propagation is favored by the ingress of water from marshy places. It is particularly noxious on rice land of thin growth, and is apt to colonize alleys and similarly exposed situations. The plants should be collected to dry before any seeds are shed.

Mariscus dilutus (Cyp.).—One traveling accross a rice country will notice the brown heads, like clusters of heads, scattered here and there, conspicuously standing above the green rice crop. *Mariscus dilutus* "Barasbarasan" (Tag.), or "Balayang" (Pang.) is a larger member of the Balangot family, growing mootly on dikes and ditch banks. Regular stand of it is restricted to certain sections. Not considered troublesome generally.

Panicum stagninum (Gramineaea).—Sometimes called "Paang pato." A coarse grass growing in semi-irrigated land. Height, between 80 centimeters and 150 centimeters. Matures seed late in November and December. Heads or racemes are not infrequently gathered with the rice. The plant is one of those very hard to pull out on account of the root system. Prolific.

Gumpay Calàbao seeds (*Ischaemum rugosum*, var. *distacyum* Merr.).—When rice is harvested with "Lincao" the heads of the grass get into the haya or bundles of sheaves, and the foreign grains are threshed and pass through the flailing mill, with those of rice. In this way man, perhaps unconciously, is siding nature in disseminating the seed of a bad weed.

Coöperative fertilizer experiments: Experiment No. 1.—The field was planted to "Magasawang palay" on August 16, just after the fertilizers were applied as top dressing and harrowed in lightly. The seedlings at the time of transplanting were 50 days old. The field was only slightly weeded, for the weed growth was thin; irrigated only by rain.

The yields of paddies computed to one hectare, follows:

TABLE XXXI

Plot No.	Fertilizer	Application per hectare	Yield of crop per hectare
		Kilos	*Kilos*
N	Ammonium sulphate	20 N	1249
P	Acid phosphate	10 P_2O_5	[a] 780
K	Potash salt	15 K_2O	[b] 908
Cao	Lime	500 Cao	826
Chk	Check		[c] 811
NP	Ammonium sulphate	20 N	
	Acid phosphate	10 P_2O_5	1,143
NK	Ammonium sulphate	20 N	1,005
	Potash salt	15 K_2O	
PK	Acid phosphate	10 P_2O_5	851
	Potash salt	15 K_2O	
NPK	Ammonium sulphate	20 N	
	Acid phosphate	10 P_2O_5	1,143
	Potash salt	15 K_2O	

[a] Yield reduced by disease. [b] Slightly affected by disease. [c] Average yield of four plots.

Increased yields were obtained in all plots which received ammonium sulphate, alone or in combination with other fertilizers. The increase amounted to 324 kilos on average, and was equivalent to 40 per cent of the check crop.

An estimate of the profit which would accrue if ammonium sulphate were to be used on one hectare of rice crop is here submitted:

The market value of 324 kilos or 7.43 cavans of palay gained by fertilization, at ₱4 per cavan		₱29.72
Cost of 100 kilos ammonium sulphate, for 1 hectare	₱9.50	
Freight charges and cost of applying	2.50	
Total expenses		12.00
Gain		17.72

Coöperative Experiment No. 2.—The test was carried in two separate fields at Alabang, herein designated, as Field No. 1 and Field No. 2. Both lands were rated third or fourth class with respect to productivity, and depend on rainfall for water supply. Field No. 1 was planted August 13, 1923 to Macan rice, the seedlings being about 50 days old. The crop was harvested December 21. Toward the close of September the plant presented stunted appearance; arrested growth and paling of the leaves' color. Search for insects had failed, and the condition was attributed to physiological disturbance in the soil. The disease appeared in more or less severe form in the two fertilized plots, although during the course of one month or so the plant seemed to have been able to recover normal color and the general condition looked better than the two non-fertilized plots.

Field No. 2 was planted on August 5, with Macan seedlings 41 days old in the seed bed. The crop was out December 31, 1923.

The fertilizers were spread just before the last harrowing was given preparatory of planting.

The following shows the results of the nitrogen fertilizers tests:

Fertilizer	Yield per hectare in kilos	
	Field No. 1	Field No. 2
Copra meal	1,231	426
Cattle dung	856	340
Check	748	371

In Field No. 1 copra meal has produced an increase of 483 kilos of palay over the non-fertilized plots. This increase is equal to 64.3 per cent. Cattle dung made, likewise a surplus yield over the check plots, of 108 kilos of palay, equivalent to 14.3 percent.

In Field No. 2 the gain obtained with copra meal amounted to 55 kilos per hectare, which is equal to 14.8 per cent. In the

case of cattle dung, however, the crop obtained fell below that of thecheck, by 31 kilos, little over 8 per cent.

Thus it follows, that in both tests copra meal made an increased yield, considerable in one, almost insignificant in the other from which no definite conclusion can be drawn.

At least in the first year of experimentation the dung may be supposed to be without effects on the rice crop, according to the results.

Experiment No. 3.—A third year experiment with a fertilizer mixture containing 3.3 per cent nitrogen, 11 per cent phosphorus anhydride and 4 per cent potash, was conducted in Rosales.

Rate of application per hectare	Yield per hectare in kilos		
	1922	1923	Average
100	925	1,902	1,413.5
300	2,346	1,930	2,138.0
500	2,140	1,732	1,936.0

PEDIGREE CULTURE

The first year culture was made of Masikaek rice, a native variety maturing in 195 days and Ryuchu, a well established variety from Formosa, maturing in 133 days and which is remarkable for its erect, non-lodging character.

Several of the pedigreed strains had been propagated. Four new varieties will be submitted to this test.

Drills vs. Broadcast planting.—This was a test on the efficiency of the two methods of planting upland rice—drill method and broadcasting. The seed used was Kinampupoy.

On one lot of ready ground, the seed was sown broadcast, and then plowed and harrowed in. On another lot of the same field it was drilled in rows 15 centimeters apart with a "Van Brunt" grain planter.

The yields per hectare are:

	Kilos
Drilled	1,137
Broadcasted	744

Hot-water seed treatment.—The hot-water (or Jonson) treatment on rice seed attacked with a fungus was tried. The seed used was that of Kathisod, a glutinous rice from Siam. Treated seed showed fungus growth during germination test, so was the crop grown from that seed.

Seed propagation.—The bulk of the propagation crop in Rosales was destroyed by the flood. At Alabang the yields had been much reduced by the unfavorable weather, characterized by drought followed by heavy rains.

Some 200 cavans of lowland rice seeds would be produced from both stations.

UPLAND RICE

The experiments on upland rice were performed at the Lamao Experiment Station. They were experiments devoted to finding superior varieties and to improving the most worthy of these by pedigree on line selection.

One hundred thirty-four upland varieties were planted in the regular variety test. Unfortunately, though, the floods which swept the station on November 18–19 had carried away the crops just before they could be harvested.

Of the pedigree culture all that was wanted for the continuation of the work, could be saved.

In the La Carlota Experiment Station at La Carlota, Occidental Negros over 36 hectares of land were planted to upland rice, and the crop is being disposed off largely as feed for the station stock, and the small better portion as seed of coöperative planting.

CORN

LAMAO EXPERIMENTS STATION, VARIETY TEST YEILDS

TABLE XXXII.—*Dry season planting.*

Variety name	Computed yield per hectare		Shelling percentage
	Ears in kilos	Grains in cavans	
Moro	3,903.24	35.49	76.42
Calamba	3,584.28	46.44	82.14
Bohol	3,267.12	42.02	80.40
Cebu	3,250.49	41.86	80.27
Calipus	3,229.35	41.59	80.30
Kalaylay	2,327.08	29.82	80.08
Ferguson Yellow	2,188.98	25.56	82.14
Ferguson White	2,840.74	38.11	83.85
Cagayan	2,046.75	27.28	82.37
Check (Moro)	2,843.75	34.77	76.42

Planted, October 24-26, 1922. Harvested, February 5-11, 1923. Area of unit plots, 438 square meters.

TABLE XXXIII.—*Wet season planting*

Variety name	Computed yield per hectare		Shelling percentage
	Ears in kilos	Grains in cavans	
Moro	696.76	7.27	65.18
Cagayan	733.80	7.78	66.31
Kalaylay	856.48	9.72	70.97
Lobo	738.42	4.75	66.46
Ferguson White	446.92	4.45	62.88
Ferguson Yellow	296.29	3.00	69.72
Check IV (Moro)	692.12	7.11	64.26
Baluga	733.80	8.42	69.00
Calipus	798.84	7.38	57.75
Calamba	1,013.85	11.70	72.16
Bohol	905.09	10.44	72.16
Check (Moro)	692.12	7.11	64.26

Planted May 24, 1923. Harvested, September 10-12, 1923. Area of unit plots, 432 square meters.

Speaking generally, the growth during the dry season was vigorous, of even stand, and producing ears of large size. Calamba Yellow, Bohol, Cebu, and Calipus were the best yielders. The last two named varieties produced practically the same yields.

Poor yields were obtained from the wet season crop because the first planting, made on May 16, 1923, was attacked by locust, and the second one herein reported was greatly damaged by the rains. Many of the plants produced no ears at all.

The Calamba, Bohol, and Kalaylay gave good yields. They had, together with the Ferguson varieties, given high proportions of shelled corn.

To check the results obtained from the dry season planting of 1922, a similar planting was done last October, but the experiment was destroyed by the flood, occasioning the loss of seven varieties.

Ear-to-the-row test.—Culture of several strains of Moro and Cagayan corns was swept away by the flood in November. It was planted in October.

Acclimatization.—Some native and foreign varieties had been procured. The following were planted: Glutinous corn, Red maiz, Cuzco, Kansan Sunflower, Argentine Pop corn, White Flint, Boone, Dikit, Mexican June, Botero, Davao Barley Flint, Waimsa, Cutete, and Forlon. The Glutinous variety, 1.25 kilos of seed were obtained. Three small sized ears of Argentine Pop and two of Dikit corn were harvested. These have been planted for further test. Ot her varieties had failed.

Distance of planting test.—The experiment has been carried on in conjunction with the variety test during one rainy season and one dry season.

YIELDS

TABLE XXXIV.—*Dry season planting*

Variety name	Computed yield per hectare in kilos			
	1 x. 70 m.	1 x .80 m.	1 x .90 m.	1 x 1 m.
Moro	3,256.00	2,851.85	3,194.44	2,879.63
Calamba	4,185.18	3,842.59	3,388.88	3,157.40
Bohol	3,333.33	3,148.14	3,504.63	3,393.51
Cebu	3,074.07	3,305.55	3,250.00	2,379.62
Calipus	3,444.44	3,430.55	3,212.96	3,018.51
Ferguson Yellow	2,175.92	2,259.25	2,148.14	2,231.48
Ferguson White	3,453.70	3,305.65	2,509.25	2,018.51
Cagayan	1,759.26	2,111.11	1,907.40	1,777.77
Check (Moro)	3,275.60	2,782.40	2,761.11	2,555.55
Kalaylay	1,490.74	1,972.22	2,083.33	3,518.51

TABLE XXXV.—*Wet season planting*

Variety name	Computed yield per hectare in kilos			
	1 x .70 m.	1 x .80 m.	1 x .90 m.	1 x 1 m.
Check I (Moro)	481.48	407.40	731.48	500.00
Moro	351.85	400.74	601.85	542.50
Cagayan	611.11	537.77	805.55	638.88
Kalaylay	685.18	759.25	944.44	833.32
Check II (Moro)	462.96	722.22	861.11	666.66
Lobo	712.96	790.74	842.59	546.29
Ferguson White	500.00	546.29	574.07	500.00
Ferguson Yellow	462.96	361.11	416.66	462.96
Check III (Moro)	1,009.25	601.85	1,037.03	824.07
Check IV (Moro)	685.18	759.25	935.28	435.18
Baluga	712.96	638.88	861.11	564.81
Calipus	555.55	712.96	692.96	573.98
Check V (Moro)	731.48	812.96	879.62	712.96
Calamba	1,101.85	777.77	1,166.66	712.96
Bohol	777.77	861.11	1,000.00	953.70
Cebu	675.92	657.41	777.77	500.00
Check VI (Moro)	777.77	666.66	1,083.33	759.25

Poor yields were gotten from the wet season test as the culture suffered from excessive rains and high winds throughout the growing period. Rats and wild hogs had also shared in the destruction.

With four out of nine varieties under the dry season planting, the yields increased with the decrease of space; four were indifferent with spacing; and one yielded in direct ratio to spacing.

Of the varieties planted for the wet season test, the best results were obtained from the 1 meter by .90 meter spacing. This distance gives ample space for the corn plants to properly develop, and allows room for cultivation.

Manifestly, if the crop is to be disposed of as animals' feeds, then close spacing of, say 1 meter by .70 meter should be adapted. For grain production, 1 meter by .90 meter would be preferable.

Another series of experiment was started with Calamba yellow corn in accordance with the following scale:

Distance	Plants per hill
1 m. x 30 cm	1
1 m. x 50 cm	1
1 m. x 70 cm	2
1 m. x 90 cm	2

The work is in progress.

Fertilizer test.—The test was confined to six plots only, each having an area of 264 square meters. Cagayan corn was planted in July.

The following tablegives the kinds of fertilizer used, estimated cost of same, rates of application and results obtained, from the experiment.

TABLE XXXVI

Plot No.	Fertilizer	Composition	Rate of application per hectare in kilos	Estimated cost of fertilizer per hectare	Cost of production per hectare	Estimated yield per hectare in kilos
1	Check	None	None	.....	P72.72	91.66
2	Ammonium sulphate Sulphate of potash Acid phosphate	N—3% K—1½% P—7%	150	P20.83	97.74	94.69
3	Do	do	600	31.81	116.02	93.93
4	Do	do	1,050	146.59	223.48	140.15
5	Mixture	N—3% K—10% P—4%	400	131.81	206.88	100.00
6	Cattle dung	N—0.5	10,000	.....	80.29	197.00

Very poor results were obtained from this test because the culture was badly affected by rains. Much of the fertilizers was washed out. At tasseling, the plants were attacked by corn boers; and no ears were found in most of them.

Hill vs. Flat cultivation and green manuring.—Experiments along these lines were carried but no results can be reported as yet.

Propagation.—The object is to propagate in a more or less extensive way the best varieties of corn for distribution to the farmers.

Below is a detailed account of the work.

TABLE XXXVII

Culture No.	Variety	Area planted in square meters	Cost of planting per hectare	Yield per hectare in kilos	Number of days to maturity
1	Calamba	860	97.21	910.46	94
2	Moro	3,200	58.75	315.31	91
3	Cagayan	3,000	59.33	619.33	87
4	Moro	6,230	80.00	1,436.33	87

Culture Nos. 1, 3, and 4 were planted on *caiñgin* land. High initial cost of operations was occasioned by the clearing and difficulty encountered in planting the field.

SUGAR CANE

LA CARLOTA EXPERIMENT STATION

Variety test—plant cane.—There were grown in this test 16 varieties of sugar cane, including the Negros Purple, which was used as check. Each variety occupied 4 rows 150 meters long, the distance between the rows being 1.20 meters. The spacing between the plots was also 1.20 meters.

Planting was made December 8–15, 1922. A block measuring 66.7 square meters was harvested November 8–15, 1923 from each plot. Sample canes were submitted for analysis. The results are given in the table below.

TABLE XXXVIII.—*Production in sugar and tonnage computed to one-hectare basis*

Variety name	Yield of cane per hectare in tons	Yield of sugar per hectare in piculs	Tons of cane per ton of sugar	Piculs of sugar per ton of cane
Yellow Caledonia	.....	.....	8.84	1.79
New Guinea 24B	87.604	.....	6.23	2.54
Malabar	75.259	107.62	11.08	1.43
Louisiana Striped	58.388	140.13	6.60	2.40
Java 247	.....	.....	8.25	1.92
Goru or New Guinea—24	88.110	183.26	7.61	2.08
Barbados	85.260	.....	6.51	2.43
New Guinea 24A	.....	.....	6.66	2.36
Rose Bamboo	43.357	104.49	6.57	2.41
Luzon 1	62.795	156.98	6.33	2.50
Luzon 2	68.582	149.48	7.26	2.18
Luzon 3	60.687	118.94	8.08	1.96
Luzon 4	89.385	146.59	9.65	1.64
Big Tanna 3525	72.678	106.10	10.84	1.46
Badila	95.913	149.37	6.09	2.60
Negros Purple	75.915	113.59	7.94	2.04

TABLE XXXIX.—*Description of stools*

Variety name	Number of stalks per stool	Length of stalks in meters	Average weight per stalk in kilos
Yellow Caledonia	3	2.05	2.25
New Guinea 24B	3	1.83	1.36
Malabar	4	1.89	2.14
Louisiana Striped	4	1.88	1.71
Java 247	5	1.91	1.23
Goru or New Guinea 24	3	1.70	1.33
Barbados	2	1.71	1.22
New Guinea 24A	3	2.05	1.31
Rose Bamboo	3	1.73	.90
Luzon 1	4	1.45	1.03
Luzon 2	4	1.63	1.15
Luzon 3	5	1.68	1.03
Luzon 4	5	1.81	1.56
Big Tanna 3525	3	1.89	1.94
Badila	4	1.62	1.33
Negros Purple	4	1.47	.98

TABLE XL.—*Analysis of the canes, eleven months old*

Variety name	Juice				Bagasse		Cane	
	Corrected brix	Sucrose	Approximate purity	Acidity	Sucrose	Fiber	Sucrose	Fiber
		Per cent			*Per cent*	*Per cent*	*Per cent*	*Per cent*
Yellow Caledonia	16.40	13.37	80.9	2.3	5.83	39.0	10.62	14.23
New Guinea 24B	18.50	16.53	89.4	1.1	8.70	37.0	14.30	12.6
Malabar	15.33	11.61	75.8	3.3	3.74	31.0	8.64	11.76
Louisiana Striped	17.10	15.56	91.7	2.4	5.51	33.0	13.25	10.82
Java 247	16.50	13.71	83.9	1.5	7.02	37.0	11.51	12.00
Goru	17.23	14.63	84.9	1.7	7.11	37.0	12.18	11.98
Barbados	18.33	16.28	89.0	1.4	8.12	39.0	13.48	13.33
New Guinea 24A	17.63	15.71	89.1	1.4	8.63	37.0	12.99	13.98
Rose Bamboo	17.70	15.90	89.9	1.6	5.47	35.0	12.16	12.67
Luzon 1	18.00	16.32	91.0	1.5	8.22	35.0	13.42	12.42
Luzon 2	16.81	14.73	88.0	1.3	8.42	35.0	10.40	12.69
Luzon 3	15.67	13.53	86.5	1.0	8.76	35.0	11.70	13.30
Luzon 4	13.87	11.61	84.1	1.2	8.37	37.0	10.70	10.88
Big Tanna 3525	15.67	11.88	76.1	2.3	6.43	42.0	10.20	12.69
Badila	19.47	17.35	89.0	1.6	11.07	37.0	15.99	7.95
Negros Purple	14.31	14.10	86.3	1.4	8.41	33.0	12.16	11.17

NOTE.—The percentage of juice extraction by hand mill ranges from 61.8 (New Guinea 24A) to 78.5 (Badila). The average for Negros Purple is 66.5.

Java 247, Yellow Caledonia, New Guinea 24A, Guro (New Guinea 24) and Badila gave very high tonnage yields. New Guinea 24A, New Guinea 24B, Barbados and Java 247 gave high sugar production. The results on commercial basis will be submitted in due time.

Variety test—first year ratoon.—Of the 16 varieties ratooned, the Goru ranked first among the first year ratoon crops, yellow Caledonia second, and Java 247 third. In sugar production, however, Barbados lead the list, with Java 247, Yellow Caledonia, and Luzon 2 coming in order.

The crops were ratooned January 9, and the canes were harvested November 9–15, 1923.

The yields in the following table are computed from 15-square meter plots.

TABLE XLI.—*Production in tonnage and sugar computed to one hectare*

Variety name	Yield of cane per hectare in tons	Yield of sugar per hectare in piculs	Tons of cane per ton of sugar	Piculs of sugar per ton of cane
Badila	38.42	91.82	6.62	2.39
Barbados	68.36	.....	3.44	2.91
Big Tanna 3525	68.42	101.26	10.70	1.48
Goru	84.57	122.62	10.92	1.45
Java 247	73.28	161.95	7.16	2.21
Luzon 1	55.28	140.41	6.23	2.54
Luzon 2	65.37	143.59	7.23	2.19
Luzon 3	49.50	123.25	6.36	2.40
Luzon 4	46.28	108.29	6.77	2.34
Malabar	68.35	112.09	9.65	1.64
Negros Purple	50.28	120.67	6.60	2.40
New Guinea 24A	43.00	88.15	7.72	2.05
New Guinea 24B	47.28	99.76	7.50	2.11
Rose Bamboo	45.28	104.59	6.85	2.31
Yellow Caledonia	80.70	157.38	8.12	1.95
Louisiana Striped	57.71	115.97	7.88	2.01

TABLE XLII.—*Description of stools*

Variety name	Number of stalks per stool	Length of stools in meters	Weight per stalk in kilos
Badila	4	1.30	1.05
Barbados	4	1.40	1.33
Big Tanna 3525	4	1.52	1.95
Goru	4	1.51	1.47
Java 247	6	1.29	0.95
Luzon 1	4	.93	.82
Luzon 2	3	1.00	.93
Luzon 3	5	1.17	.77
Luzon 4	5	1.14	.72
Malabar	4	1.39	1.33
Negros Purple	5	1.16	.78
New Guinea 24A	6	1.76	1.04
New Guinea 24B	4	1.12	1.38
Rose Bamboo	6	1.14	.71
Yellow Caledonia	4	1.62	1.98
Louisiana Striped	4	1.41	1.16

TABLE XLIII.—*Analysis of canes, ten months old*

Variety name	Juice				Bagasse		Cane	
	Corrected brix	Sucrose	Approximate purity	Acidity	Sucrose	Fiber	Sucrose	Fiber
		Per cent			*Per cent*	*Per cent*	*Per cent*	*Per cent*
Badila	18.5	16.21	87.6	2.1	7.62	26.5	13.29	10.81
Barbados	16.6	14.64	93.8	3.6	6.13	19.0	11.45	14.58
Big Tanna 2525	15.0	11.66	77.7	3.7	5.93	35.5	9.53	13.10
Goru	18.5	13.14	71.0	2.9	6.30	37.0	10.70	13.70
Java 247	17.4	15.17	87.1	3.1	6.16	36.0	11.52	14.50
Luzon 1	18.1	16.56	91.4	2.4	9.38	35.0	13.15	11.69
Luzon 2	16.43	14.64	89.1	2.0	7.70	34.6	12.32	12.60
Luzon 3	17.13	15.90	92.3	1.7	7.09	32.5	12.48	12.60
Luzon 4	16.47	15.15	91.9	1.6	9.98	39.0	13.27	14.15
Malabar	15.90	12.59	79.2	5.0	7.10	31.3	10.24	13.30
Negros Purple	17.57	15.27	90.3	2.8	10.12	38.3	13.78	13.80
New Guinea 24A	15.93	13.98	87.7	2.4	7.79	56.0	11.49	14.40
Rose Bamboo	16.93	15.27	90.1	2.8	8.20	35.0	12.89	11.86
Yellow Caledonia	16.03	13.69	85.4	4.9	6.11	39.0	10.67	15.62
Louisiana Striped	16.00	13.88	86.7	1.8	8.15	34.3	11.59	7.61

NOTE.—The percentage of extraction by hand mill ranges from 57.5 (New Guinea 24A) to 77.8 (Louisiana Striped). Results in commercial basis to be submitted later.

Fertilizer experiment.—Negros Purple cane was planted in the first week of December, 1923 in two series of plots. Hills were distanced one meter apart from row to row and 40 centimeters in the rows. Plots measured 50 meters long and 10 meters wide each and were separated by strips 1.5 meters wide.

Fertilizers were applied on May 9, 1923 approximately five months from the date the cane was planted. The following table shows the kinds and compositions of the fertilizers and rates of applications used. The figures on tonnage and sugar yields being of sample cuttings only do not represent the final yields, which will be submitted after the crops of the entire cane has been milled.

TABLE XLIV

Kind of fertilizer	Composition			Rate of application per hectare	Average yield of cane per hectare in tons	Average yield of sugar per hectare in piculs	Sucrose in cane average analysis
	N	P_2O_5	K_2O				
	Per ct.	*Per ct.*	*Per ct.*				*Per cent*
Ammonium sulphate	20	.....	.....	200	109.9	147.7	9.64
Treble superphosphate	.....	47	.....	520	.....	.....	12.49
Potassium sulphate	.....	.....	20	150	166.5	170.2	11.81
Lime	. . .	. . .	.....	500	105.8	183.5	10.54
Ammonium sulphate Treble superphosphate	20	47	.....	720	.....	. . . .	12.58
Ammonium sulphate, P. S.	20	. . .	20	350	162.0	143.6	10.24
Potassium sulphate Treble superphosphate	.....	47	20	670	95.0	.....	11.09
Ammonium sulphate Potassium sulphate, T. S.	20	47	20	870	97.2	150.2	9.72
Ammonium sulphate Potassium sulphate Treble superphosphate Lime	20	47	20	1,370	87.0	123.3	9.40
Control	.....	.....	.....	.....	90.0	.....	12.40

Distance of planting test.—The results so far were not so marked with respect to yields as those of last year experiment, but it was again evident that close spacing, 80 by 10 centimeters, for instance, gives a higher net production of cane and sugar than the open planting, 1.20 by 40 centimeters; and this relation appears to be fairly well kept up for every graduation of spacing. Whereas it required 6½ tons of cane to make a ton of sugar in closely planted plot, according to analysis, it took little less than 6 tons of cane in open planted plot to produce the same amount of sugar.

The ability of Badila plant to maintain an erect position, as compared to Negros Purple, is a distinct advantage from agronomic view point.

Mosaic disease experiment.—The mosaic and non-mosaic Negros Purple cuttings were planted on December 28, 1922. On February 26, 1923, hills were examined for the number of dead and number of living hills. Another counting was made on October 31, 1923.

TABLE XLV.—*Number of mosaic and healthy hills; death rates given*

Plot No.	February counting—numbers						October counting—numbers					
	Mosaic			Healthy			Mosaic			Healthy		
	Living hills	Dead hills	Death rate	Living hills	Dead hills	Death rate	Living hills	Dead hills	Death rate	Living hills	Dead hills	Death rate
			Per ct.			*Per ct.*			*Per ct.*			*P. ct.*
1	688	352	41.9	744	296	36.6	642	46	3.9	702	42	3.2
2												
3	514	526			376		514	0		642	22	
4				664								
5	611	429			569		586	25		669	0	
6												
Total	1,813	1,307	41.9	1,977	1,143	36.6	1,742	71	3.9	1,913	64	3.2

The following tables give the average measurements taken with the cane stools of the mosaic and healthy plants, the percentage of sugar contained in the cane, etc.

TABLE XLVI

Plot No.	Seed cane	Number of stalks per stool	Weight per stalk	Length of stalks	Diameter of stalks
			Kilos	*Meters*	*Centimeters*
1, 2, 5	Mosaic	3.6	1.66	1.18	7.9
2, 4, 6	Healthy	5.4	1.30	1.31	8.3

TABLE XLVII.—*Analysis*

Plot No.	Seed cane	Sucrose in cane	Tons of cane per ton of sugar	Piculs of sugar per ton of cane
		Per ct.		
1, 3, 5	Mosaic	12.91	7.17	2.21
2, 4, 6	Healthy	13.65	6.54	2.42

Acclimatization test.—Several new varieties were introduced in Lamao. The more promising varieties and strains are the H–109 seedling, Barbados Striped, New Guinea 40 sport, H–27 seedling, Inalmon No. 2—P1, Inalmon No. 1—P1, Nalagacho and Tapol. The "C. A. C" strains from the College of Agriculture, University of the Philippines, are adapted to local conditions.

Experiment on large vs. *small-sized points.*—The experiment involved the planting of 25,000 points (Negros Purple) with the aim to find out if there was any advantage to be gained in selecting large-sized points with well developed "eyes" for planting. Accordingly, the points were sorted and grouped into large-sized points and small-sized points. A third lot was made up of mixed sizes.

The crop was still in the field when the report was being written, yet to judge from the results of measurements there would be little or no difference since the selection was not based on individuality of plants.

Average figures

Points	Number of stalks per stool	Height of stalks	Diameter of stalks	Length of internodes
		Meters	*Centimeters*	*Centimeters*
Big sized	7	1.16	2.60	8.15
Small sized	7	1.15	2.58	8.09
Mixed sizes	7	1.20	2.58	8.09

Seedling cane production.—Larger collection of seeds has been obtained this year, from a number of leading varieties of sugar cane at La Carlota and Alabang.

At La Carlota the Inalmon and Hawaii–109 seedling canes, which were grown from seed 1921 are still under observation. Of the 1922 stock, there have been just recently planted in the nursery two selected stools of Java 247 and one stool of Formosa variety. The seedling plants of tamato did not survive at La

Carlota. Inferior individuals have been discarded. In Alabang Rice Station ratoon plants of Badila seedlings were allowed to grow. One of these has produced a large number of fine stalks. Cuttings of same have been set out in the field.

Growing of sugar cane for seed; costs of production of.—The La Carlota Experiment Station has made an estimate of the expenses incurred in connection with the raising of sugar cane on four hectares, and gives the cost of production per hectare as follows:

Items	Expenses
Preparation of land	₱120.00
Planting (including value of seed cane)	52.00
Cultivating	130.00
Harvesting and haulding	138.00
Total	440.00

CANE PROPAGATION

Seed canes for general distribution are propagated on a large scale at the La Carlota Experiment Station, while limited quantities are grown at the Alabang and Lamao Experiment Stations.

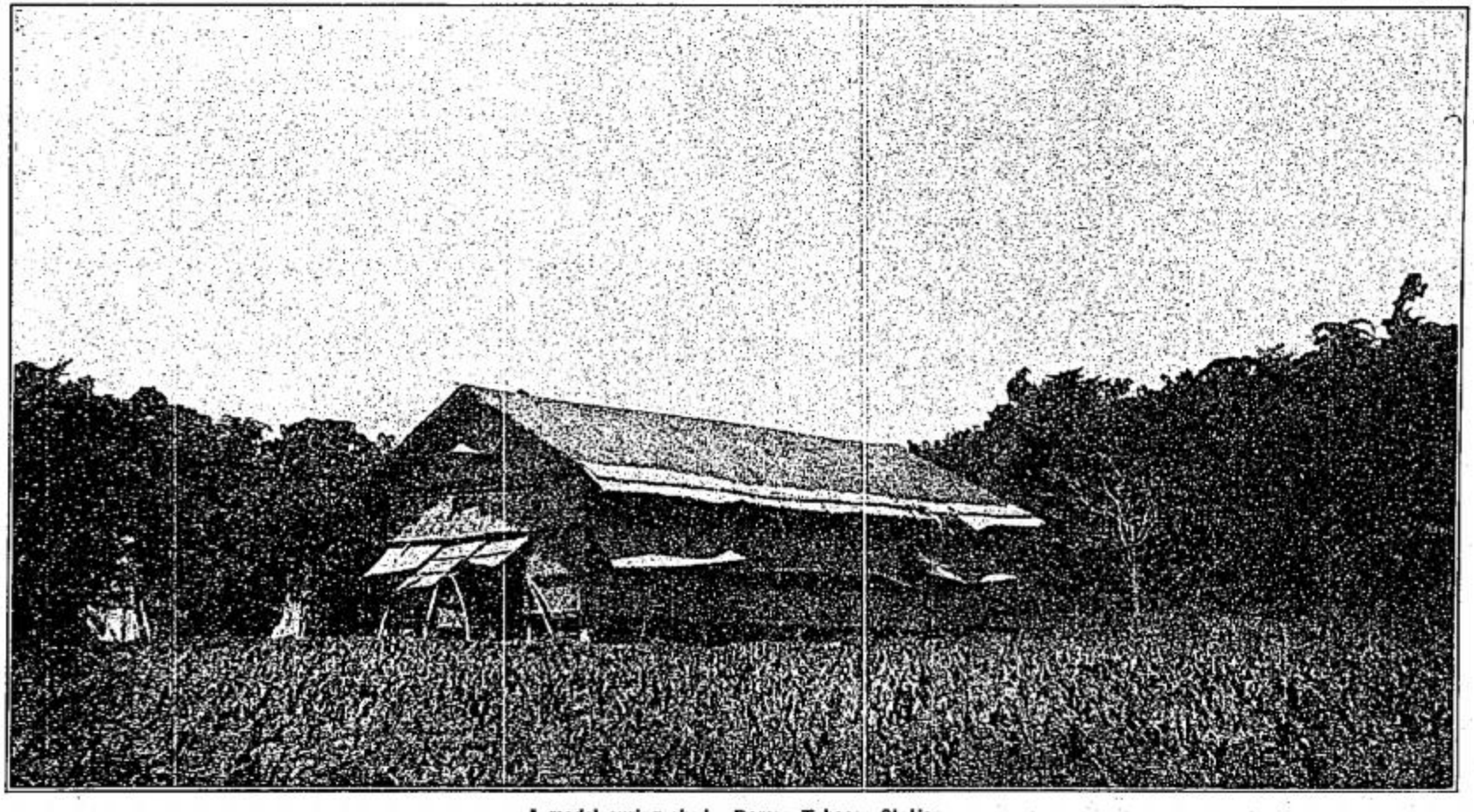
TOBACCO

DAMMAO TOBACCO STATION

The activities of the Dammao Tobacco Station at Gamu, Isabela during the year have been principally the further testing of promising native varieties and strains and the acclimatization of equally or more promising foreign varieties. The former were on the whole, bred for high yield and the latter for wrapper suitability. Two hectares were employed for the tests. It is expected that barring adverse conditions during the tobacco season, at least 30 fardos of wrappers, 30 fardos of binders and 140 fardos of fillers will be raised incidentally from all the experimental cultures.

Seed beds.—Because originally it was intended to supply pedigreed seedlings to all the coöperators of the station, 2 hectares of seed beds were prepared and sown but these were destroyed only by the record November flood. However, the other seeds in stock were sown immediately on seed beds covering an area of one hectare. The good germination of these insured a sufficient supply of seedlings for the cultures during the ensuing tobacco season, for which at least 40,000 seedlings will be required.

Vitality tests of seeds.—This experiment was incidentally carried out in connection with the open beds and the germinating boxes of all the seeds of the different varieties and strains used



A model curing shed. Damao Tobacco Station

in the variety and propagation tests conducted by the station. Three important points were observed. First, under the same conditions, different varieties and strains of tobacco exhibit different degrees of viability, ranging from 65 to 95 per cent for fresh seeds and from 10 to 50 per cent for 1 year-old seeds. Vigorous strains of 11–Espada Dammao and 12–Dammao Broadleaf showed as high a germination as 80 per cent when the seeds are stored in well-sealed paper packages kept in Mason fruit jars. Experience with these jars show though that the viability of seeds stored in them falls after one year, to about 50 per cent. Second, a very high germination percentage is obtained under controlled conditions as in the case of germinating boxes which could be kept safely in a shed. Irregularity in weather conditions in the Cagayan Valley is responsible for irregular germination percentages for the same strain or variety in different seasons. Third, provided germination is well controlled, 10 mother plants can easily supply seedlings to plant two hectares of tobacco land. In this year's seed beds an individual plant of 18–Florida Sumatra produced at least 3,000 fine healthy seedlings.

Acclimatization tests.—The foreign varieties 18-Florida Sumatra, 35–Sumatra, 1–Connecticut Havana, 28–Havana, 35–Dumbara and 36–Bahis were used. Of these varieties only the 18–Florida Sumatra showed normal performance although rather markedly susceptible to mosaic.

General variety test.—In addition to the six foreign varieties already referred to, 10 native varieties were used in this experiment, namely: 34–Anipa Sumatra, 53–Dammao Medium Hybrid (three types), 12–Dammao Broadleaf, 14–Dammao Medium Broadleaf, 11–Dammao Espada, 4–Palattao Broadleaf, 49–Cauayan, 10–Dammao Medium Repollo, 6–Anipa Broadleaf, and 51–Angadanan.

Four noteworthy points were observed in this experiment. First, the native variety as a whole showed the best vegetative performance whereas the foreign varieties with the exception of the 18–Florida Sumatra, were deficient in some way or other. Second, 12–Dammao Broadleaf showed the greatest number of standard leaves (26 as well as by a very high breadth index [47%] for a typical filler strain.) Third, 11–Dammao Espada proved itself to be the most prolific grower but unfortunately possessed the lowest breadth index (39%). Fourth, 6–Anipa Broadleaf showed itself to be a great possibility by surpassing by 1 per cent the breadth index of 12–Dammao Broadleaf although it had 3 less leaves.

Effect of spacing on planting.—The varieties 18–Florida Sumatra, 12–Dammao Broadleaf, 14–Dammao Medium Broadleaf, 54–Anipa Sumatra, and 58 Dammao Medium Hybrid No. 1 were used in this experiment. Two distances were employed.

(*a*) 70 by 70 centimeters.

(*b*) 50 by 80 centimeters.

No favorable results were obtained in this experiment owing to the May showers which washed away the gum from the leaves and which incidentally made the leaves susceptible to all kinds of leaf spot diseases. A noticeable change in texture was, however, observed which warrants the repetition of this experiment

Wrapper variety tests.—In this experiment, the varieties 53–Dammao Medium Hybrid No. 1, 54–Anipa Sumatra, 14–Dammao Medium Broadleaf, 11–Dammao Espada, 12–Dammao, Broadleaf, 4–Palattao, 17–Pampano, 10–Medium Repollo, 49–Cauayan, 50–Echangue and 1–Connecticut Havana were used. Shade was provided by a partially cleared young forest and by alternate rows of corn. In the first case the plants were set out 50 by 50 centimeters apart and in the second, 50 by 80 centimeters. The first method was quite successful especially in the case of the native 4–Palattao. The second method was a failure as the plants were very much affected by mosaic.

Curing experiment.—This experiment was conducted in order to compare the modified native method with certain foreign approved methods, namely, (1) Face-to-face and back-to-back, (2) Face-to-back, and (3) Cubanin which the leaves are pierced with twine so that they ride alternately on the poles. The controls were the native methods of (1) partially curing the leaves in the sun and afterwards hanging them up in the curing shed and (2) partial sun-drying and afterwards hanging them under the house.

Observations made during the experiment showed that all the methods tried with the exception of the two alternative native methods, were satisfactory. With the Cuban method the leaves cured one day earlier but this difference is immaterial. The method followed at the station is a sort of the modified native method. The leaves are strung side by side, folded in *palillos* capable of holding at least 50 leaves and allowing a finger-breadth, between the leaves. The leaves are racked directly into the shed for complete shade and slow curing. This method showed as favorable results as the approved foreign method.

Preliminary histological studies.—These studies were incidentally started in an attempt to account for the so-called "quality"

of wrapper leaves. The relatively well-developed cuticle of the Sumatra seems to be responsible for its ability to stand the stress to which it is subjected to in spite of its thinness which amounts almost to transparence. On the other hand, its central parenchymatous cells appear to be very weak as they (cells) cannot be well-defined when the leaf is cured and fermented. Curiously enough, these facts are reversed in the native Dammao Medium Broadleaf, that is, the latter has a relatively poor cuticle but a stronger central parenchyma.

Seed and seedling distribution.—There were distributed in all 19,470 seedlings representing seven different varieties and 51.62 kilos of seed of ten varieties.

PIKIT TOBACCO STATION

The work of the Pikit Tobacco Station has been in the main, the continued planting of the wrapper varieties, and the experiments for the acclimatization and improvement of same. The acreage devoted to the crop increased from two hectares in the 1922–1923 season to three hectares during the ensuing season. The present crop, if conditions remain normal, may be expected to be about 1,000 kilos of wrapper tobacco and twice that quantity of binder and filler leaves.

Seedbeds.—Two nurseries were prepared. There were 94 seedbeds of moderate size. Over 100,000 seedlings were raised, pricked and distributed. Sowing was done in October.

Experiment on the intensive and extensive methods of planting.—The extra amount of care and consequent outlay per unit area with the modern way of planting is greater than in the case of the native method, but, it has been observed that there is a greater development and more uniform stand of the plants than by the former method, that may more than compensate for the extra work and expense. The experiment is being tried in four plots having 1,000 square meters each. The Florida Sumatra tobacco was used.

Seasonal planting.—Seasonal plantings at Pikit have been carried on through two sets of experiments that is, the first set was planted in the months of April and May, for off season crops, and the second set was planted in September and October for regular season crops. In the first set the variety used was Baker Sumatra. The area planted was limited. In the second set, however, several varieties, all of the wrapper class, have been used. The September planting included the Baker's Sumatra, the two newly received S. P. No. 1 and S. P. No. 2, and Florida Sumatra; while the October planting has comprised all

these varieties plus some hybrids. Greater acreage has been employed with the two regular season plantings. The crops planted in April for trial during the off season was a failure on account of the seedlings having been attacked by insect borers during the seedlings stage.

Better results were secured with the crop planted in May. While the growth was uneven as a result of different ages of seedlings transplanted. The production was large, and the percentage of wrapper was correspondingly so. The sowing of this crop was done on May 19 and the seedlings were transplanted beginning July 16, 1923. Harvest was begun on September 6 and continued up to October 20. The leaves were classified into two classes; the wrapper class, and binder-filler class. The quantity of these 2 classes follows:

TABLE XLVIII

Variety	Area planted	Production		Wrapper	Production per hectare		
		Wrappers	Binder and filler		Wrappers	Binders	Total
	Sq. m.	*Kilos*	*Kilos*	*Per cent*	*Kilos*	*Kilos*	*Kilos*
Baker's Sumatra	100	6.2	7.8	44.2	618.8	781.2	1,400

The results indicate that the raising of the off season crops planted in May is more or less profitable. With regard to the regular season planting the first sowing was done in September and the second sowing in October. The crop planted in September has been considerably delayed in transplanting, and thus gave rise to the poor stand of the Florida-Sumatra variety. However, this delay did not affect in anyway the Baker's Sumatra and the two S. P. varieties, all of which showed good growths. The harvest of these crops have been made in December.

Plant-to-the-row tests with hybrid plants.—Approximately 2,000 square meters of ground have been planted to several selections of the following hybrids.

Field No.	Parent plants	Station name	Row Nos.
A	Sumatra—Florida Sumatra		1-20
B	Florida Sumatra—Sumatra		21-40
C	Dammao Broadleaf—Sumatra	Dammatra	41-50
D	Connecticutt—Sumatra	Connatra	51-56
E	Havana—Sumatra	Havanatra	67-77

A test on distances of planting for these hybrids is underway. There are grown separate plots of B-X hybrids. Florida Sumatra hybrids show distinct improvement in the texture of leaves over the parent plants.

Tephrosia candida is being tried by the station as shade plant for tobacco. It was planted at the end of June in rows running north and south, and set 4½ meters apart. In the middle of November, four to five months afterwards, four rows of Florida Sumatra were planted in between the rows of *Tephrosia candida*, at a distance of 90 centimeters from one another; also five rows each of Baker's Sumatra, S. P. No. 1, S. P. No. 2, and B-X hybrid, at a distance of 80 centimeters from one another. The total area covered by this experiment is 7,830 square meters.

Variety and acclimatization tests.—Inasmuch as filler varieties, or at least most of them, do well in the Cotabato Valley there is no need of further experimenting with them. The station was specially interested in the wrapper varieties and has therefore set out Baker's Sumatra, S. P. No. 1, and S. P. No. 2, and Florida Sumatra, in connection with the variety test.

S. P. No. 1 and S. P. No. 2 are new varieties of the Sumatra class. S. P. No. 1 resembles Baker's Sumatra in form and general appearance. S. P. No. 2 has wider and greener leaves than No. 1. Culture of the latter variety under the seasonal planting experiment indicates that it is quite susceptible to chlorosis.

The two new varieties and Sumatra American-grown, Bohia and 199–Hybrid Montgomery are growing in the acclimatization test plot.

Distances of planting with wrapper varieties.—Distances have been arranged to conform to plant types, thus with Baker's Sumatra, which is small leafed type the distances are:

90 cm. x 50 cm.
90 cm. x 40 cm.
80 cm. x 40 cm.
50 cm. x 50 cm.

With the broad-leafed Florida Sumatra wider spaces are provided:

100 cm. x 50 cm.
100 cm. x 40 cm.
80 cm. x 57 cm.
90 cm. x 40 cm.

Distribution.—There have been distributed from the station seedlings and seeds of wrapper tobacco, in quantities stated elsewhere in this report.

FORAGE CROPS

Lamao experiment station—Comparative test.—The following tables give the number of cuttings and aggregate yields obtained from each species.

TABLE XLIX

Name of grass	Computed yield per hectare in kilos	Name of grass	Computed yield per hectare in kilos
Check I (Guinea)	240,894	Check II (Guinea)	110,405
Napier	313,037	*Paspalum dilatatum*	111,998
Guinea	184,439	Para	112,413
Guatemala	143,746	Bugalon	28,720
Cayenne	32,265	Check III (Guinea)	111,080

Distance of planting test.—The distance of planting between the rows was 1 meter; the distance between hills in the rows varied in this test, from 25 centimeters to 40, 55, 70, and 85 centimeters for each crop.

The following table shows the aggregate yields from cuttings made every 40 days.

TABLE L

Name of grass	Computed yields per hectare in kilos				
	1×.25	1×.40	1×.55	1×.70	1×.85
Check I (Guinea)	8,660.00	7,885.71	7,240.00	6,720.00	5,597.14
Napier	15,515.15	13,851.51	11,000.00	10,848.48	10,336.66
Guinea	6,893.65	6,308.00	6,090.00	6,088.88	5,092.06
Guatemala	6,900.00	6,314.28	5,385.71	4,980.00	4,185.71
Cayenne	621.43	521.42	435.71	414.28	300.00
Check II (Guinea)	3,898.18	3,918.09	3,316.36	3,403.63	2,909.02
Paspalum dilatatum	4,181.25	3,618.75	3,600.06	3,100.00	3,106.25
Para	3,073.32	2,706.66	2,720.00	2,360.00	2,258.33
Bugalon	446.66	446.66	413.33	413.33	353.33
Check III (Guinea)	3,308.00	3,098.41	2,768.25	2,679.52	2,482.53

The yields increase as distances between the plants decrease. Lost results were produced by the distance of 25 centimeters and 40 centimeters in the row.

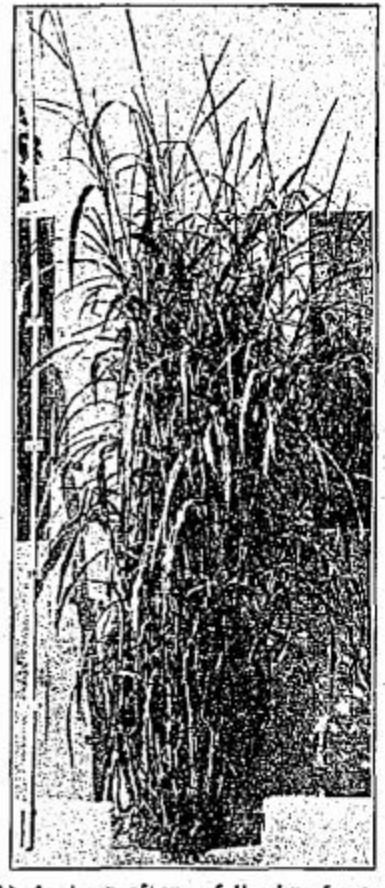
New introduction.—This work has for its object the propagation of introduced plants found adapted to Philippine conditions.

The following table shows a list of the new forage plants and record of trials.

TABLE LI

Name of plant	Source	Area planted	Date planted	Germination test	Adaptability	Remarks
		Sq. m.		*Per cent*		
Australian blue grass	Hawaii	2.00	8- 5-23	0	Fair	Plants died.
Wonder forage	do	20.00	5-10-23	40	do	Included in forage yield test.
Pennisetum setosum	do	20.00	5-10-23	45	do	
Zacate blanca de Honduras	Cuba	20.00	5-10-23	87	do	
Exphorus unisetus	Hawaii	3.00	8- 5-23	60	Poor	Carried by flood.
Pennisetum complanatum	do	2.00	8- 5-23	0	.....	
Juda	do	.90	8- 5-23	0	.....	
Fussy top	do	2.00	8- 5-23	0	.....	
Bayakibok	Santa Cruz, Laguna	100.00	8-18-23	70	Promising	Growing luxuriantly in paddle soil.
Merker	.....	130.00	8- 5-23	95	Good	Growth, same as Napier.
Pennisetum longistalum	.....	.....	.....	.....	Died	Plant received in dried condition.
Panicum antidotali	.....	2.00	8- 5-23	0	.....	

(a) A clump of Guatemala grass (*Tripsacum laxum.*) Lamao Experiment Station



(b) A clump of one of the two forage grasses received from Trinidad Agricultural School. Lamao Experiment Station.

Yield and feeding tests of grasses.—The following table shows the yields per cutting on one hectare basis:

TABLE LII

Name of	Yield of grass when cut at—							
	20 days old	30 days old	40 days old	45 days old	50 days old	60 days old	75 days old	90 days old
	Kilos	*Kilos*	*Kilos*	*Kilos*	*Kilos*	*Kilos*	*Kilos*	*Kilos*
Check (Guinea)	39,121	63,713	36,260	.....	33,180	68,420	.....	.....
Napier	64,807	97,392	65,414	39,474	74,045	111,379	62,834	40,000
Guinea	35,008	37,962	31,162	23,871	28,329	51,978	41,584	28,400
Guatemala	1,585	37,814	27,764	11,897	28,340	47,743	19,780	17,000
Cayenne	26,543	1,193	2,329	2,614	1,364	836	19,010	28,000
Check (Guinea)	13,513	17,669	17,707	.....	20,171	41,845	.....	.....
Paspalum dilatatum	25,103	23,675	17,913	15,511	18,538	26,719	15,000	13,780
Para	27,140	29,453	13,180	9,460	13,480	29,160	18,404	16,530
Bugalon	11,260	11,200	2,073	871	2,147	2,040	8,687	14,980
Check (Guinea)	14,510	23,026	14,606	.....	26,461	32,477	.....	.....
Uba cane	.....	.....	.....	16,041	.....	.....	26,760	45,105

The following table gives the percentage of grass consumed by animals, per cutting:

TABLE LIII

Name of grass	Percentage of feed grass consumed by animals when cut at—							
	20 days old	30 days old	40 days old	45 days old	50 days old	60 days old	75 days old	90 days old
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
Check (Guinea)	100	100	91	.....	65	69	.....	.....
Napier	100	86	78	74	59	87	48	41
Guinea	100	100	91	86	65	69	54	49
Guatemala	100	100	100	100	100	96	95	82
Cayenne	100	.....	.....	24	.....	33	21	15
Check (Guinea)	100	100	91	.....	65	69	.....	.....
Paspalum dilatatum	100	100	100	92	90	78	79	65
Para	100	100	100	88	92	72	69	71
Bugalon	100	100	100	100	.....	.....	100	84
Check (Guinea)	100	100	91	.....	65	69	.....	.....
Uba cane	.....	.....	.....	98	.....	.....	95	85

In this feeding test bullocks were used. When the grass was out at 20, 30, 40 and 45 days old, practically all parts of the plant were eaten clean by the animals. The leaves and stalks of the grasses cut after 45 days of growth had become hard and tough, and were not all relished by the animals.

The Cayenne grass becomes unpalatable as it advances in age and should be given to animals while yet young.

The leaves of *Paspalum dilatatum* and Para grasses were too dry for soiling, when the plants attained some degree of maturity.

In the case of Uba cane, Napier, Guinea, and Guatemala grasses, it is the stalks that were rejected by the animals when cuttings were made of old growth.

Cuttings of the Bugalon were all consumed regardless of the age of plant, which remained fresh and excellent throughout the year.

This experiment could give hints of the palatability alone, and would take several experiments to test on the net amounts consumed and food values as measured by increased weights of the animals fed.

Test of sorghum, ragi, millet, and adlay for forage.—To determine the value of these crops a trial plot was made during the year. Planting was made on July 6–7, 1923.

The following table gives the yields and percentage of feed consumed.

TABLE LIV

Name	Amount cut before flowering[a]	Amount cut at flowering[b]	Computed yield per hectare		Per cent of feed consumed	
			Before flowering	At flowering	Before flowering	At flowering
	Kilos	*Kilos*	*Kilos*	*Kilos*		
Sorghum	97.0	117.8	20,208.33	24,541.66	55	35
Ragi	36.0	56.3	9,000.00	14,075.00	100	95
Millet (suayo)	16.5	28.4	3,875.00	7,100.00	100	80
Adlay	46.0	76.2	11,500.00	19,050.00	100	80

[a] On September 25, 81 days after date of planting.
[b] On November 28, 145 days after date of planting.

Sorghum gives most stuff, but its acceptability is low compared with other plants tried. Ragi, millet, and adlay were all consumed when given at flowering stage, 90 days from planting.

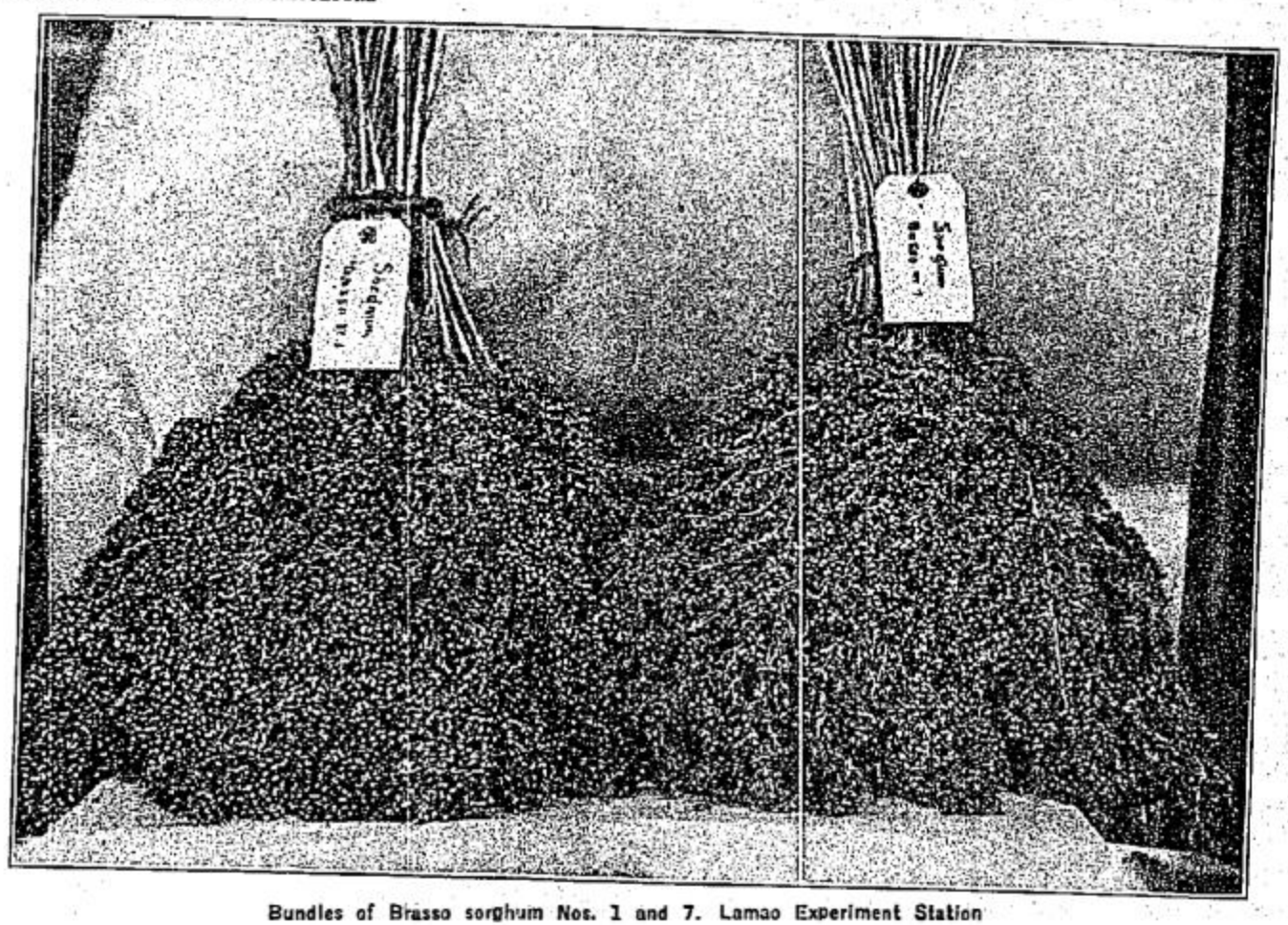
Propagation.—This work aims at multiplying suitable forage plants for distribution purposes.

The following table gives the names of grasses, area planted to each, etc.

TABLE LV

Name	Date of planting	Area planted	Condition of growth
		Sq. meters	
Napier	6-10-23	982.50	Excellent.
Guinea	6-10-23	851.50	Do.
Uba cane	6-11-23	327.50	Do.
Jaragua	6-11-23	131.00	Poor.
Merker	6-11-23	65.50	Excellent.
Paspalum dilatatum	6-12-23	131.00	Good.
Bugalon	6-13-23	65.50	Fair.
Molasses	6-13-23	131.00	Very poor.
Guatemala	6-13-23	131.00	Excellent.

At present there is at Lamao ample stock of Napier and Guinea grasses for distribution and a limited quantity of Uba cane, Merker, and Guatemala grasses.



Bundles of Brasso sorghum Nos. 1 and 7. Lamao Experiment Station

The propagation of forage crop for distribution purposes is being done at Alabang Rice Station, aside from that of Lamao. At the Alabang Rice Station, manimanian, an uncultivated native leguminous plant is being domesticated. Wide cultivation of this grass as horse feed, specially, is to be encouraged.

The varieties of sorghum, Guinea grass, Guatemala, Merker, Napier, and Uba cane are being grown at Alabang on about three-fourth of a hectare in extent.

In La Carlota the Uba cane, Para grass, Guinea, and Napier are grown, mostly as feed for the work animals.

FIBER INVESTIGATIONS

GUINOBATAN ABACA TRIAL STATION

The Bureau has established this year the Guinobatan Abaca Trial Station in the municipality of Guinobatan, Albay, some two kilometers away from the town proper on the Guinobatan–Ligao road. This station began operation on September 25, 1923. Most of the work was given to clearing of the land. This is half hilly and half plain, comprising about ten hectares.

The region is supposed to be typical of abaca region with even distribution of rainfall, and no pronounced maximum rain period nor pronounced dry season.

Experiments.—Very little was done as yet in the way of experiments. One experiment set up is included to find out the age and size with which an abaca sucker must be planted so as to give the best results. Another experiment was started with a view to measuring the value of mulching in the abaca plantation. There are two ways of preparing abaca strips in vongue locally known as "lucnet" and "bacnes," and the station has committed itself to investigate which of the two is the more advantageous.

The collection of plants of the local varieties, together with preliminary classification of same had been undertaken.

At Lamao Experiment Station—maguey and sisal.—Small plots had been planted to maguey and sisal, for future seed stock. An experiment is in progress with these two plants, which would determine the right distance for planting them at Lamao.

Comparative yield test of agave sp., etc.—In this experiment are incorporated, the maguey, agave, zapupe, Nenequen, Sansevieria Zeylanica, S. zulcata, and others. The size of the plots vary with the number of seed plants there were available at the time of planting.

TABLE LVI.—*Cotton*

Variety name	Computed yield per hectare	Remarks
	Kilos	
Sea Island (Check)	.....	
New Baykin	130	
Ferguson	161	
Lone star	243	
Cambadra	150	
Sea Island (Check)	74	
Kinastila	.....	Not yet in bloom.
Carabonica	.....	Soon to be harvested.
Toquello	14	
Cuban Brown	.....	Not yet in bloom.
Sea Island (Check)	.....	

Cotton planted in the months of May, June, and July died from too much rain. This suggests that the planting time should be so arranged so as to avoid putting the seeds in water clogged soil and allow both to mature during the dry season of the year.

The highest percentage of germination with cotton was recorded from seed placed in dry sawdust, giving a viability of 38 per cent after a four month keeping. This was closely approached by seed kept in charcoal. Two months afterwards, the seeds tested 10 and 12 per cent, when kept with sawdust and charcoal, respectively, in air-tight cane.

Roselle.—The Archer, Victor, and Rico are being propagated. One hundred plants of each of the White and Red-fiber roselle were harvested. The amount of fibers extracted is 1.8 kilos from the White-fiber variety and 1.4 kilos from the Red-fiber variety.

AT LA CARLOTA EXPERIMENT STATION

Abaca.—At the La Carlota Experiment Station the fiber project has been, with the exception of some minor experiments, reduced to the maintenance of the abaca fields, necessary to meet occasional demands for suckers and seeds. There were given away in 1923, 800 suckers and 3,500 grams of seeds of abaca representing 27 varieties. The plantation, despite of the little care the station was able to give it, has been in good condition. It was possible for the station to collect specimens and to perform experiment on the relative proportion of fiber contents therein. Comparison has been made of plants from suckers and those raised from seeds. It appears from the data obtained that seedling plants gave on the average greater percentage of fiber, than sucker plants. There is also probability

that seedling plants are more resistant to heart-rot disease than the plants grown from suckers, according to the results.

Miscellaneous fiber plants.—There are now at La Carlota a good number of Panama Hat Palm suckers that can be distributed. The stripping of the fibers and bleaching were attempted there with little success.

Jute, Ramie, Anabo, and Tikog are the other fiber plants in Lamao, worth mentioning.

MINOR CROPS

LAMAO EXPERIMENT STATION

TABLE LVII.—*Yields of varieties of peanut grown during the wet season*

Variety name	Area of plot	Amount of seed used	Yield of plot unshelled nuts	Computed yield per hectare		Shelling percentage
				Kilos	Cavan	
	Sq. m.	*Kilos*	*Kilos*			
Check I, Chinese	90	0.30	4.72	886.50		
San Mateo	60	0.21	3.30	790.25	32.25	65
Japanese	90	0.27	1.64	351.25	13.77	68
Spanish	60	0.23	2.34	642.50	26.77	78
Kinorales	60	0.25	1.56	426.15	16.39	69
Vigan Lupog	30	0.09	2.84	1,114.80	42.07	69
Valencia	60	0.21	0.98	351.50	18.26	59
San Jose No. 1	90	0.28	3.90	604.60	26.28	61
San Jose No. 2	60	0.24	4.64	1,155.75	43.61	66
San Jose No. 3	60	0.26	3.51	1,071.90	42.03	61
North Carolina Running	180	0.50	0.30	625.55	24.53	60
Tennesse Red	150	0.52	8.63	1,066.70	41.83	65
Chinese	360	0.22	15.22	880.35	39.66	60
Check II (Chinese)	360	0.23	15.22	886.50		

Septoglim arachidis, which causes leaf spots, appeared in all plots when the plant was approaching maturity.

A piece of ground one-half hectare in area, was planted to six most productive peanut varieties. The November floods wrought damage in all plots.

TABLE LVIII.—*Test with the yellow and green mongo crops planted*

Variety name	Area planted	Amount seeds planted	Dates		Germination
			Planting	Germination	
	Sq. m.	*Kilos*			*P. ct.*
Yellow mongo	2,841	2.5	10-31-23	11-4-23	94
Green mongo	5,683	6.2	10-31-23	11-4-23	96

Variety name	Area planted	Amount seeds planted	Dates		Harvesting
			Flowering	Fruiting	
	Sq. m.	*Kilos*			
Yellow mongo	2,841	2.5	12-1-23	12-15-23	Not yet matured.
Green mongo	5,683	6.2	12-1-23	12-15-23	Do.

Yields of varieties grown for cover crops. Crops planted: December 27, 1922 to January 10, 1923.

Variety name	Area planted	Amount of seeds planted	Estimated cost of operation per hectare	Computed yield per hectare
	Square meters	*Kilos*		*Kilos*
Yellow mongo	6,320	7.02	P29.27	37.24
Do.	4,386	4.00	37.84	112.40

Much greater yields should have been produced but for the shade of trees which had interfered very much with the growth.

TABLE LIX.—*Cowpeas production*

Variety name	Amount of seeds planted	Days to maturity	Cost of planting per hectare	Computed yield per hectare
	Kilos			*Kilos*
Cowpea (7991)	2.52		P50.47	295.83
New Era (7990)	2.30		52.13	242.08
Cowpea (7991)	1.80		60.00	224.31
New Era (8237)	2.85		62.37	70.70
Cowpea (7991)	4.60	87	26.07	295.83
New Era (7990)	4.00	92	42.61	229.16
Cowpea (7991)	2.00	92	43.16	237.38
New Era (8237)	5.20	95	19.62	36.95
New Era (7990)	3.50	90	63.61	257.58
Cowpea (7991)	2.20	90	73.86	211.36
New Era (8237)	3.80	90	53.31	191.64
Kibal	43.00	93	9.03	37.02

This test was not carried outside by side but on different fields. The low yields were attributed partly to the depredation of aphids and grubs especially on the kibal bean. Shades had affected growth. New Era cowpeas ranked the highest in point of yields.

Propagation of cowpea on a large scale is in progress this year. About a cavan of seeds has been planted after the typhoon or before the close of the year.

Acclimatization of cowpeas and soy beans.—The initial planting of the Brabhems, clay, iron mixed, and whippoorwill cowpeas ran into vines, but the crops raised from Lamao-grown seeds showed that each and everyone of the introductions do well in Lamao.

Seven varieties of soy bean were received from Manchuria, China, within the last quarter of the year and were planted. They had grown well, but the pods were damaged by insects while green.

The seven varieties of soy bean from the United States Department of Agriculture and Yokohama, Japan, planted in Lamao produced good pods, but no seeds were formed probably due to excessive rain during podding period.

TABLE OF PRODUCTION OF SOY BEAN

(Date planted: December 20–27, 1922)

Variety name	Area planted	Amount of seeds planted	Days to maturity	Cost of planting per hectare	Computed yield per hectare
	Sq. m.	*Kilos*	*Kilos*		*Kilos*
Amis Soy	1,075	5.02	115	P51.72	491.16
Soy Bean	1,200	5.12	110	52.92	303.03
Black Soy	1,680	5.18	106	30.95	169.05
Amis Soy	840	1.30	97	72.61	190.47

TABLE LX.—*Yields of adlay of the year 1923 variety test*

Variety name	Amount of seeds planted	Yield in kilos	
		Actual	Per hectare
	Kilos		
Check (Momungan)	0.23	7.70	778.72
Lamao	0.21	7.39	747.36
Davao	0.24	4.40	444.98
Bukidnon	0.25	6.41	648.25
Lamao White No. 1	0.25	9.06	916.23
La Union Red	0.28	16.25	1,643.40
Mountain Province	0.27	12.56	1,270.22
Cebu	0.24	6.71	678.60
Check (Momungan)	0.23	7.70	778.72
Batangas	0.29	6.87	694.78
La Union White	0.21	8.56	865.69
Lamao No. 2	0.23	4.85	499.49
Bontoc	0.23	5.66	572.41
Lanao	0.27	4.67	472.28
Mountain Province	0.32	2.48	250.81
Momungan	0.23	9.57	967.83
Cotabato White	0.20	5.40	546.11
Check (Momungan)	0.23	7.70	778.72

Area of unit plots, 98.88 square meters.
Date of planting, June 5–6, 1923.
Date of harvesting, November 22–27, 1923.

The best varieties to come out of the test are La Union Red, Mountain Province, Momungan, Lamao White No. 1, and La Union White.

Distance of planting test.—Two varieties of adlay were under this test:

(1) The dwarf type, Mountain Province.
(2) The tall type, Bukidnon.

Distances used:

1 meter x 30 centimeters.
1 meter x 40 centimeters.
1 meter x 50 centimeters.
1 meter x 60 centimeters.
1 meter x 70 centimeters.
1 meter x 80 centimeters.

Bukidnon was planted June 10, 1923; Mountain Province was planted July 5, 1923.

The cultures are still growing.

COMPARATIVE YIELD TEST AND PROPAGATION OF SORGHUM

1. Number of varieties under test..... Three.
2. Date of planting..... May 15, 1923; July 6, 1923.
3. Date of germination..... Four days after planting.
4. Method of planting..... By drilling the seeds in furrows and then covered with soil by harrow.
5. Spacing ..... Eighty centimeters between rows.
6. Frequency of cultivation..... Three times.
7. Method of cultivation..... Twice by the use of cultivator and lastly by the use of plow.
8. Date of harvesting..... December 5–21, 1923.

TABLE LXI.—*Yield of comparative test of sorghum*

Variety name	Area planted	Amount of seeds planted	Days to maturity	Cost of operation		Yield in kilos	
				Actual	Per hectare	Actual	Per hectare
	Sq. m.	Kilos					
Basso No. 1	850.50	1.50	200	P6.95	P81.71	83.10	977.07
Basso No. 7	1,874.25	2.04	216	15.30	81.63	87.10	464.72
Lamao	1,019.81	1.85	148	9.45	92.72	26.79	261.81

According to results given above, the Basso No. 1 sorghum gave the highest production and Basso No. 7 the next.

Acclimatization of sorghum and millet.—Several varieties of sorghum and millet had been received from Manchuria. Trials were made with them. It looked as if none was superior to the ones previously tried.

AT LA CARLOTA EXPERIMENT STATION

White kibal, cowpeas, soy bean, mongo, and peanuts were planted for green manuring at La Carlota. The white kibal planted at the beginning of the rainy season had made heavy foliage there. Very few seeds, however, were produced. The rainy season crops of the bean, on the other hand, yielded abundant beans. This was planted in October. A small plot of peanuts had been raised; much of the crop was prepared into fodder and fed to animals.

AT ALABANG EXPERIMENT STATION

New Era cowpeas, kibal, and soy beans were also cultured chiefly for the object of rotating with sugar cane.

GENERAL FIELD INVESTIGATIONS AND COÖPERATIVE TRIAL PLANTINGS ON SPECIAL PROJECTS

RICE

Field activities other than those of the experiment stations have been and are being carried.

For the purpose of investigation there have been established temporarily six so-called rice districts, two of which are in Pangasinan, two in Nueva Ecija, one in Tarlac and one in Cavite. This investigation has been carried on to find out the most productive varieties suited to the locality and to eliminate low-yielding varieties found which are often a cause of low production.

In the parts of Pangasinan Province covered by this investigation; that is, the municipalities around Rosales and Tayug the rice land is generally sloping and is traversed here and there by streams coming from the Caraballo Mountain. The experiments conducted with the dry season planting with a number of varieties (Sipot and Mangasa) have given encouraging results, indicating that a second rice crop can be profitably grown on land provided with irrigation.

Extensive rice fields are located in Santa Rosa and Licab districts, Nueva Ecija. Cultural methods used are much more improved than those in Pangasinan. Only the "Tagalog" or beardless palay is grown. The land is flat, and is watered by the rain. The prevailing soils seem to be rich, of the loamy clay or clay types. Much of the planting is done by community system. The threashing is done by machinery in certain sections of the provinces. Kilns and hullers are used extensively.

In the Alabang–Imus district, which comprises the municipalities of Imus and Tanza, Cavite Province and Muntinlupa, Rizal, the soils are heavy clay and shallow. Most varieties cultivated are early or medium late, except in certain irrigated sections of Tanza and Imus, where the late sorts are also grown. There are reasons to believe that such varieties found in this district will do quite well in Nueva Ecija and vice versa.

Not less than 70 varieties have been tried in coöperators' plots in the provinces above named including that of Tarlac. The results were rendered obscured by the abnormal climatic condition during the season. However, the preliminary results from the coöperative trial planting indicate the adaptability of some of the varieties introduced that have proved good in certain places. In Cavite and Nueva Ecija a number of new varieties (Khan, Bai, Ori, and Ramai and Cabungui) had produced greater yields than the local rice.

SUGAR CANE

A survey of the leading varieties of sugar cane grown in Pampanga, Laguna, and Batangas Provinces was made. In Pampanga there is the Pampanga Red which is quite widely grown

in that province. Of the introduced varieties the Badila, Yellow Caledonia, and the Hawaii 109 now being tested by the Bureau, would be likely to succeed. In the Province of Laguna, the Negros Purple, Cebu Purple, and Pampanga Red are now more or less commercially grown. Of these the most popular is the Cebu Purple. Badila and Yellow Caledonia are planted on a small scale. The two purple varieties are known there to make a heavy crop and the sugar production is decidedly superior to the native white. The sugar industry in Batangas is not well developed. The average production per hectare in that province is about 30 tons of cane, as against 40 tons in Laguna, according to investigations.

At La Carlota, Occidental Negros 35 hectares of land have been grown to foreign varieties of sugar cane in coöperation with the farmers. In Pampanga there are 23 coöperative trial plots planted to different varieties while in the Calamba district six coöperators have also been secured. The varieties that are being tried include the Badila, Java 247, and H–109.

ABACA

Survey of production.—The extent to which this phase of abaca investigation in Albay has been carried was far too small to give even a superficial information on the value and cost of abaca production.

So far the visits made to several plantations in the districts of Daraga, Camalig, Guinobatan, Jovellar, and Ligao, have failed to reveal the presence of heartrot disease. The rootrot was noticed in Camalig and Guinobatan, and two positive cases of it were discovered in the station. This disease may be supposed to exist in large plantations in Albay. Advice as to control measure to be taken has been given to planters. It can be said that the frequent typhoons crossing that country every year, would predispose the plant to contract fungus diseases as a second course.

TOBACCO

The tobacco coöperative trial planting is being conducted in Isabela, Cagayan, and Cotabato Provinces.

Sixty-eight growers have planted Government seed in Isabela, representing seven varieties most of which are of the wrapper type, including the Florida–Sumatra, Baker–Sumatra and crosses of wrapper strains and native varieties. The damping-off and heavy rains destroyed most of the seedling although the beds have been replanted.

In the Province of Cagayan 26 growers have planted seeds of selected varieties in coöperation with the Bureau of Agriculture.

In Cotabato there were 32 coöperators who have planted selected varieties of wrapper tobacco in coöperators with the Pikit Tobacco Station. Some of these coöperators have grown a good quantity of the Florida–Sumatra variety successfully. The quality of their crop was such that ₱2.50 per kilo was offered for same in Manila.

That the tobacco coöperators were satisfied is proved by the fact that their crop for the ensuing tobacco season will be grown from the seed supplied them from the Dammao and Pikit Tobacco Stations:

HORTICULTURE

CITRUS FRUITS

Acclimatization.—The following table gives the number of species, varieties, and trees under cultivation at Lamao and Bontoc stations during the year 1923 as compared with those of 1922.

TABLE LXII

Items	Lamao			Bontoc
	1922	1923	Increase or (decrease)	1923
Species	24	24	.....	6
Varieties	476	470	6	9
Trees	934	947	13	17
Area in hectare	2.88	2.88	.....	.....

The trees at Bontoc Station are not yet fruiting although the plants are growing fairly good. The results presented below are drawn from the observation made at Lamao.

Oranges.—Among the varieties which fruited this year 2695 Brown was the heaviest yielder; 1270 St. Michael, second; and 2568 Misamis, third. The yields were 517, 400, and 330 fruits, respectively. The fruits of the different varieties are of variable size, but 3660 Balanga has the biggest fruit; 1714 Larrantta, second; and 1636 Washington Navel, third. As to quality the following varieties are the best: 3660 Balanga, 1636 Washington Navel, 3886 Duroi, 2568 Misamis, 1639 Ruby, 1260 Excelsior, 2686 Pineapple, 1635 Pineapple, 2694 Majorca, 1259 Malta Blood, and 4119 Dugat. The other varieties except 4117 Brown, 1266 Whitaker, 1706 Valencia, 2695 Brown, and 1701 Holdfast are good also and rank next to the above named best varieties.

As to juiciness, 3660 Balanga has the greatest percentage of juice; 2568 Misamis, second; 1639 Ruby, third; 4123 Magnum Bonum, fourth; and 3886 Duroi, fifth.

Two thousand five hundred sixty-eight Misamis has the least number of seeds and 1266 Whitaker, 4124 Carleton, 1720 Bahia, and 1634 Washington Navel occupy the second place.

Among the varieties of oranges that bear fruits out of season this year are Balanga, Misamis, Pineapple, Ruby, Dugat, Brown, Excelsior, and Enterprise.

Pomelo.—2265 Lukban gave the highest yield; 1633 Case was second; 3673 Siamese, third; and 1995 Siamese, fourth. The yields were as follows in the order of their enumeration: 138, 63, 60, and 18 fruits.

Three thousand three hundred ninety-one Pomelo has the largest-sized fruits. 3384 Saigon, second and 3673 Siamese, third. As to quality 3673 Siamese is the best; 3391 Yugelar, second; and 3442 Siamese, third; and as to juiciness they are all medium. The Saigon has the fewest number of seeds, then 3442 Siamese comes second and 3673 Siamese, third.

Grapefruit.—2687 Duncan gave a yield of 123 fruits 4118 Walter 96, 1631 March 90, 3882 McCarthy 88, and 1632 Triumph 59. Triumph No. 1632 and 1713 are the best varieties.

Mandarin orange.—1272 Kishiu was the highest yielder; 3383 *C. nobilis*, second; 5173 Saagkam, third; 2693 King, fourth; and 1265 China, fifth with a yield of 100, 89, 65, 25, and 16 fruits, respectively. The Kishiu and King are the best varieties both in quality and flavor.

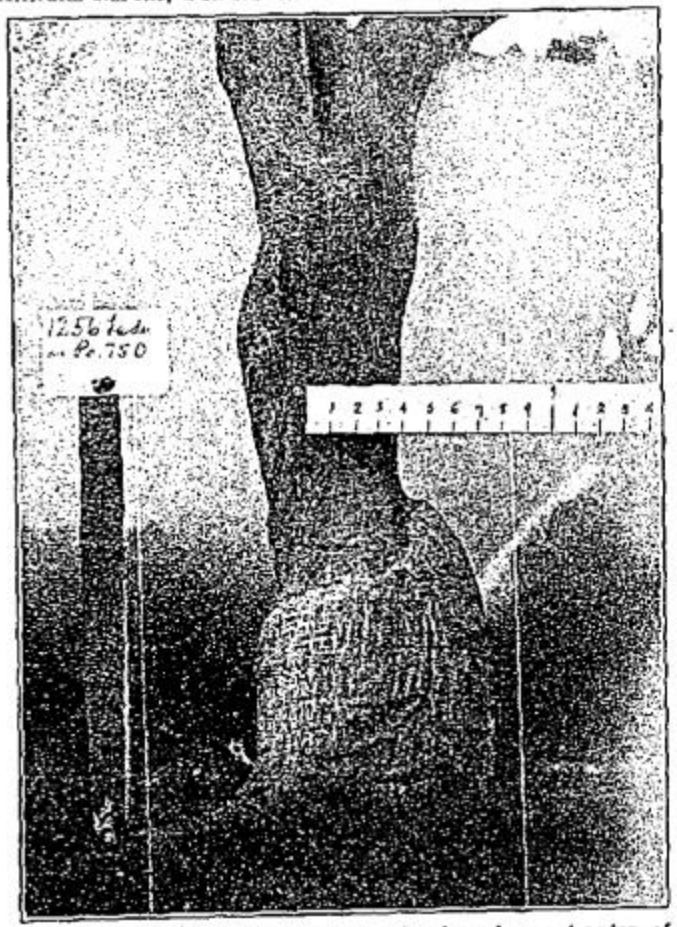
Lime.—The same results as last year were obtained from the limes.

Calamondin.—The three best yielding varieties are P. I. Nos. 2513, 2355, and 2332. The first variety yielded 2,710 fruits.

From the yields given above it must be taken into consideration the fact that the different trees were planted on different dates and fields, and the yields were all per tree.

Stock test at Lamao.—To determine the value of the different citrus especially the native species as stock plants. This study has reference with the congeniality of stock and its influence on the scion as regards the productiveness of the latter and the quality of the product; and with the resistance of the stock to diseases as well. Seedlings of fifteen varieties of citrus were already transplanted in outside nursery for this purpose.

At Tanauan.—The growth of Batangas mandarin budded on Calamondin and rough lemon and on Batangas mandarin as a check, has been studied, and the observations show that there is



(a) Mandarin budded on pummelo showing abnormal union of stock and scion

(b) Aniali (*A. senegalensis*) budded on *Areticulata* showing abnormal union of stock and scion

but a slight superiority of the foreign stocks over the mandarin stocks, as far as growth is concerned. However, this cannot be taken as final, because the trees are only in their prime stage of development.

Forcing citrus at Lamao.—Smudging citrus trees has been tried with various full-grown trees in the orchard that have never produced fruits or that are shy bearers with the object of finding out the apparent effect of smudging upon citrus plants. The work has been performed once a day for three weeks during February and October. Among the trees smoked only 4,124 and 1995 Siamese pummelos have flowered.

At Tanauan.—The following methods have been tried on mandarin trees:

1. Smudging.
2. Ringing.
3. Debarking.
4. Root pruning.

Smudging was practised with and without sulphur fumes. One set of trees were smudged during the latter part of March and another set during the latter part of April. Smudging was done every day, except on Sundays, from morning until evening, for nine days. The sulphur used was broken into fine particles, and small quantities were thrown little by little over the fire during the day.

The following table indicates the results obtained in smudging mandarin trees.

TABLE LXIII

Lot No.	Method	Period of smudging	Number of trees	Number of fruits produced	Average yield per tree
1	Check I	March 22–31, 1923	4	42	10.00
2	Smudged without sulphur	do	4	19	4.25
3	Smudged with 150 grams sulphur	do	2	4	2.00
4	Smudged with 100 grams sulphur	do	2	274	137.00
5	Smudged without sulphur	April 25 to May 4, 1923.	4	22	5.50
6	Smudged with 100 grams sulphur	do	4	1,274	318.50
7	Check II	do	4	80	20.00

The favorable influence of sulphur fumes has upon the fruiting of the mandarin trees is shown in the table above. This would be verified next year.

Ringing and debarking of branches of mandarin trees with a diameter of 3–5 inches was performed on May 12, 1923. Debarking was performed by removing the bark by cutting off strips about 0.25 inch wide and halfway around the circumference of the branch of the tree. No beneficial effects upon the fruiting of the trees were observed from either method, but instead they became injurious to the branches.

There was no noticeable effect upon the fruiting of the trees by root pruning.

Cover cropping and mulching at Lamao.—Fourteen different legumes and the *Passiflora edulis* were tried as cover crops. Generally, the planting was a failure because of excessive rains. However, the Lyon and the velvet beans withstood the rainy season, and they both grew luxuriantly and gave fairly good yields. The peanut produced a good crop but did not cover the ground well. The cadios gave an excellent growth and it is probably the best cover crop on a full-grown citrus grove.

For mulching sugar-cane leaves, bamboo leaves, cogon, talbak, rice straw, and miscellaneous grasses have been tried. The rice straw is the best material found for mulching citrus plants since it conserves the soil moisture and checks the growth of weeds well. It is best to spread it all over the ground in the row of trees to brown oranges dropped to the ground before reaching maturity.

Rejuvenation at Tanauan.—The change in the management of the rundown mandarin orchard, from a noncultivated and crowded condition to a cultivated and more open condition, was begun four years ago. The immediate effect of this new treatment was at first unfavorable to the fruiting of the trees. A comparison of this orchard with an adjoining one, however, which was formerly the better portion of the plantation, shows that the rejuvenated orchard is better, not only in its fruitfulness but also in the general condition of growth of the trees.

Top-working the old mandarin trees has been done extensively during the year with the hope to rejuvenate the old trees by this system. Several varieties of citrus have been budded, and those that have been worked out in previous years are growing vigorously and a few of them fruited for the first time this year. The grapefruit and pummelo scions budded during the year remained dormant.

At Lamao.—Two methods are being employed; one is to pile soil or dirt around the base of the trunk of the diseased trees to induce them to produce a new root system and the other by planting stock plants around the trees for bridge-grafting afterwards.

Observations of diseases and pests and their remedial measures at Lamao.—The susceptibility of the various species are as follows:

Citrus aurantifolia.—Only one case of pink disease appeared on this species. In general the different varieties under this species were susceptible to barkrot, and only one variety was

(*a*) No. 1334 Pernambuco grape (*C. maxima*) budded on No. 2162 citrus showing abnormal union of stock and

(*b*) Aisem (*C. webberi*) budded on *C. excelsa* showing abnormal union of stock and scion

resistant to the disease. All the varieties except one were susceptible to canker.

C. aurantium.—Only one variety was affected slightly by barkrot. This species is more or less resistant to canker. Some were susceptible while others were not but in most cases, the diseases appeared in a very slight form. Mottled leaf was observed in this species.

C. excelsa.—The different varieties were susceptible to barkrot. Canker was very prevalent in this species.

C. histrix.—In general, this species was not susceptible to barkrot. Some varieties were very susceptible while others were resistant. The different varieties were more or less resistant to canker. Mottled leaf appeared in only four varieties.

C. limonia.—It was more or less susceptible to barkrot and canker. Mottled leaf was found only in one variety.

C. medica.—It was found susceptible to barkrot, but more or less resistant to canker. One tree died from barkrot.

C. maxima.—Only one case of pink disease occurred during the year in this species. It was more or less resistant to barkrot. Some varieties were attacked slightly while others were not. All the varieties in this species were affected with canker in varying degrees. Mottled leaf appeared also in all the varieties in different degrees.

C. mitis.—Barkrot appeared only on one tree while mottled leaf on two trees.

C. nobilis.—It was more or less resistant to barkrot. Only the mandarin type was attacked by barkrot. It was very resistant to canker. Only one case of footrot was observed during the year. Mottled leaf appeared in varying degrees.

C. sinensis.—Three cases of pink disease were observed. Barkrot appeared in varying degrees. Nearly all the varieties were susceptible to canker. Only one case of footrot was found. Mottled leaf appeared in nearly all the varieties in varying degrees.

C. southwickii.—It is more or less resistant to barkrot and canker.

C. webberii.—It was more or less resistant to barkrot and canker. Mottled leaf appeared in a slight degree.

C. longispina.—It was more or less resistant to canker. Mottled leaf appeared in varying degrees.

C. hybrids.—Nine cases of pink disease were observed during the year, and three trees were killed by it. The different hybrids exhibited different degrees of resistance to canker. Some of them were greatly affected, others were so in slight degree

only, while two of them were very resistant to canker. Mottled leaf is affecting nearly all the varieties in varying degrees.

Time of appearance of the diseases at Lamao.—Pink disease appears during the rainy season, barkrot and footrot during the latter part of the dry season, and canker and mottled leaf throughout the year.

Remedial measures at Lamao.—In the treatment of barkrot, the carbolineum is found better than the creoline treatment because the cut portions on the former case unite easily. It took two months to callus while in the creoline treatment it was much longer. Also in the latter treatment, the tree may be severely affected that it may die or it will take time before the tree recovers. In the lime sulphur spray for the control of barkrot and canker no result was obtained.

Pests at Lamao.—The most destructive insect which attacked the citrus fruits is a certain fly which deposit her eggs in the fruits and when the eggs hatched the larvæ cause the fruits to fall down. The remedial measures applied was sanitation; that is, the collection and destruction of fallen fruits. The other insect enemies are the mealy bug, scale insect, and the red and black ants which make their nests on the twigs of the trees. The destruction made by the mealy bug and scale insect is unnoticeable and therefore no remedial measure was applied. The remedy applied to the ants was the burning of their nests with a torch, which is very effective and economical measure.

At Tanauan.—The following table shows the comparative extents of barkrot on mandarin groves of the station and the neighboring plantations:

TABLE LXIV

	Number of trees examined	Total affected	Per cent of infection	Cover crops used
At the stations:				
B1—A	26	5	19.2	Tephrosia.
B1—A	37	9	24.3	Cowpea.
B1—A	44	9	20.5	Cadios.
B1—A	143	16	11.2	
B1—B	49	11	22.4	Soy bean.
B1—B	108	23	21.3	Madre de cacao.
Outside groves:				
Cultivated	57	39	68.4	
In caifigin	70	38	54.8	
Brushy	64	18	28.1	
Near the house	78	29	37.2	

The foregoing table shows that there is much less barkrot in the station than elsewhere. This can only be attributed to the better treatment given to the plants at the station.

Inoculation of barkrot to healthy mandarin trees, at Tanauan.—An experiment was conducted to find out whether or not barkrot was contagious by inoculating the healthy trees with:

1. Strips of bark tissue taken from an active barkrot disease.
2. Strips of bark taken from the outside part of the decayed zone of the area affected with the disease.
3. The liqued exuding from an active barkrot.
4. Surface soil taken from the ground near a tree affected with barkrot.

The cuts made previous to the inoculation were disinfected with a 5 per cent solution of carbolic acid, and they were all supposed to be strong and healthy portions of the trees.

The experiments have shown in a definite manner the infectious character of the barkrot disease. The first inoculation process has shown both positive and negative results. The liquid exuded by the active barkrot disease was shown to transmit readily, while the bark tissues taken from the outside of the affected bark and the soil from the ground near an infected tree were incapable of producing the disease.

Remedial measures at Tanauan.—The trees affected with barkrot were treated with carbolineous, the trees were pruned off and the trunks witewashed with Bordeaux mixture. Asphaltum was used in dressing the wounds. This material has proven better than the white lead in that it makes a good protective coating, it is not much affected by the weather and it is cheaper.

Variety test of citrus at Tanauan.—The new mandarin orchard is at present planted to 431 budded plants, 48 seedlings, and 31 stock plants; and the variety test orchard to 8 species, 50 varieties, and 244 trees. A number of trees in the variety test orchard have blossomed during the year but Villafranca lemon, Pineapple orange, and Calamondin are the only varieties that produced fruits. Among the mandarin trees, the tree No. S17 gave the highest yield, B65 second, and B315 third. The yields were 545, 415, and 320 fruits, respectively.

The following table gives the summary of all the citrus plants under cultivation at the station during the year as compared with those of 1922:

TABLE LXV

Item	Total		Increase	Remarks
	1922	1923		
Species	10	12	2	Eleven strains of native orange, 14 of Batangas mandarin and 4 of native pummelo were considered as individual varieties.
Varieties	46	121	75	
Trees	930	1,385	435	
Area in hectares	3.42	4.99	1.57	

Storage of mandarin fruits at Tanauan.—It was determined in 1920 that it was possible to store economically fruits of the mandarin orange in an under-ground storage chamber for 14 or 20 days, and after this time the loss was so great that storage would no longer be possible using the method employed as published in the Philippine Agricultural Review, Vol. 13, 1920, pp. 214–17. The experiment referred to above was replicated this year, the only difference is the use of disinfectants of 0.2 per cent formalin, 0.016 per cent copper sulphate, and 0.012, 0.025, and 0.05 per cent potassium permanganate; and the storage chamber was provided with a chimney and a tight door for proper ventilation. Immersion of fruits on the various disinfectants was done in 3 and 5 minutes, respectively, for each lot of fruits.

The results show that there was distinctly less decay of fruit in lots treated with potassium permanganate solution than in others. After six weeks of storage, the average loss of fruits in the lots disinfected with potassium permanganate was 25.3 per cent, in the formalin lots 33.1 per cent, in the copper sulphate lots 34.3 per cent, while in the check lot 33.7 per cent.

After eleven weeks of storage, the lots disinfected with potassium permanganate showed an average loss of 73.9 per cent, the formalin lots, 79.5 per cent, the copper sulphate lots 82.3 per cent, and check lots 80 per cent.

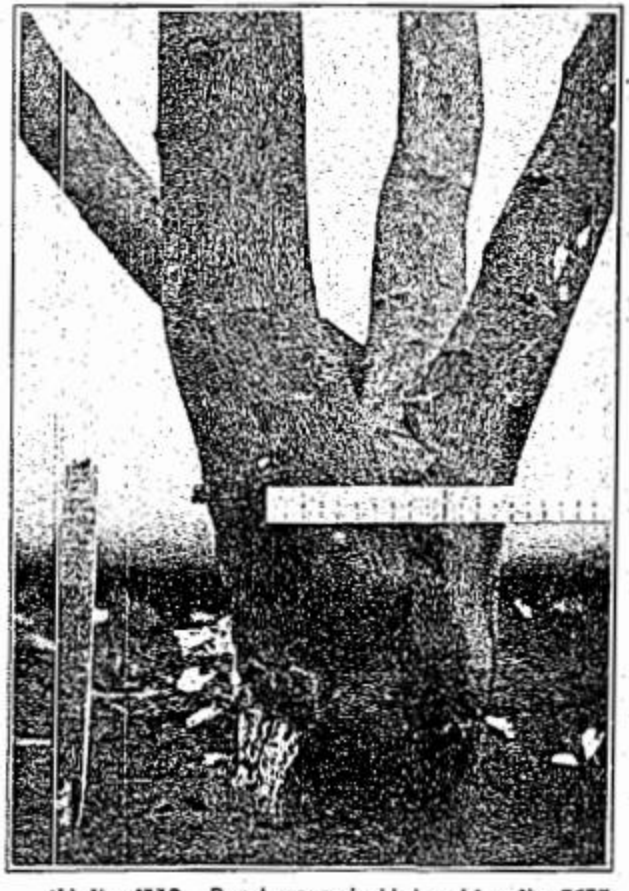
A longer time may be possible to store the mandarin fruits since some of the fruits after eleven weeks remained good.

The results obtained as to the extent of decay in fruits picked in the ordinary way and in those harvested with a clipper are the same with those obtained in 1920.

MANGO

Variety test at Lamao.—The variety test orchard reported last year has been extended from 6.97 to 8.41 hectares this year. The orchard is at present planted only to seven distinct varieties, namely: carabao, 303 plants; pico, 133 plants; pahutan, 158 plants; and 12 plants of four varieties of Indian mangoes. Fifty-two plants of miscellaneous mango have also been transplanted in this orchard during the year. Carabao and pico mangoes inarched on the different stocks, and set out during the year were included in the above figures. At present all plants that are in condition for budding and grafting have already been budded and grafted. Generally the plants are making good growth.

(a) A half top-worked mabolo. Lamao Experiment Station



(b) No. 4119. Dugat orange budded on Lime No. 3673, showing one of the methods of applying carbolineum on the bark affected with bark-rot.

Vegetative propagation at Lamao.—Trials have been made to propagate the mango by cuttings and marcotting, but so far have no definite indications of success in both cases.

In the trial made at Lamao 84.6 per cent success has been obtained in grafting *versus* 21.4 per cent in budding. It was thought then that the best way to propagate the mango by grafting, and at the same time to find out how the cost of operation may be reduced. Experiment, therefore, has been carried on to graft the mango with or without moss. The percentage obtained were 58 and 25 in favor of the use of moss.

Forcing mangoes at Lamao.—The experiment reported last year has been continued this year. The results obtained from the different methods employed are all negative except smudging. Smudging has been performed during the months of January, February, March, September, October, November, and December; and in all cases the trees smoked have flowered. The flowers, however, failed to produce fruits because of rains and insects. From the results obtained there is an indication that mango of matured leaves and twigs can be forced to flower any time of the year. Fruits may be developed if rains do not damage the flowers during fertilization or insects do not destroy them.

Top-working at Lamao.—An experiment to top-work mango tree partially or entirely has been performed during the year. New sprouts developed faster in the latter than in the former. In the case of the tree which was entirely top-worked six months after the operation the sprouts can either be budded or grafted while in the case of partially top-worked trees the new sprouts up to the present time are not buddable yet, which is now about eight months from the the time of cutting the branches of the trees, and besides there are very few sprouts that have developed.

Viability test at Lamao.—Moist saw-dust, sand, moss, and charcoal have been used in the preservation of mango seeds (husked) and that for the air-tight containers, bottles were used and bamboo tubes for the open containers.

Moist charcoal gave the best results in the air-tight containers which is 40 per cent germination after 30 days. While in the open containers moss gave the highest which is 40 per cent after 30 days, and all the seeds decayed after 58 days.

Depth of planting at Lamao.—It was found out that mango seeds planted at a depth of one centimeter gave a higher percentage of germination and germinated earlier than those planted deeper.

Fertilizer test on Excelsa coffee at Lamao.—There are 10 plots containing three trees in each plot. The fertilizer was broadcasted around the base of every tree in the plot on March 7, 1923 and heed afterwards.

The following table indicates the preliminary results of the experiment:

TABLE LXVI

Lot No.	Fertilizer	Analysis	Amount applied per tree	Actual yield in kilos	
				Berries	Cleaned coffee
		Per cent	*Kilos*		
1	Ammonium sulphate	19–20 N	0.5	9.50	2.95
2	Treble superphosphate	47.72 P205	1.0	6.01	1.86
3	Sulfate of potash	48–52 K20	0.3	.24	.07
4	Ammonium sulphate		0.5	2.40	1.08
	Sulphate of potash		0.3		
5	Treble superphosphate		1.0	3.52	1.09
	Sulphate of potash		0.3		
6	Treble superphosphate		1.0	8.71	2.70
	Ammonium sulphate		0.5		
7	Ammonium sulphate		0.5	7.27	2.25
	Treble superphosphate		1.0		
	Sulphate of potash		0.3		
8	Ammonium sulphate		0.6	1.94	.60
	Treble superphosphate		0.7		
	Sulphate of potash		0.5		
9	Fertilizer No. 2	1.83 N, 11.93 P205 2.31 K20	1.25	2.66	.82
10	Cow manure	48 N, 14 P205 1.64 K20	19.2	1.24	.38

Only one tree produced berries in Lot 3, two of each in Lots 4, 5, 6, 9, and 10. No definite conclusion can be drawn from the data presented above since the coffee harvest corresponding to this year's crop is still in progress, and from which the fertilizers applied may have direct effects.

Propagation of coffee at Lamao.—The following table gives the comparative yields of each variety per hectare.

TABLE LXVII

Variety	Number of trees		Bearing trees		Amount harvested in kilos				Remarks
					Actual		Computed per hectare		
	1922	1923	1922	1923	Berries	Cleaned coffee	Berries	Cleaned coffee	
Excelsa	213	211	159	159	421.99	131.65	2,947.42	919.59	In fruits.
Liberian	102	157	90	90	108.77	29.80	1,625.40	445.35	Do.
Robusta	44	44	.....	5	.....	.....	.....	.....	Do.
Dybowskii	40	40	3	20	.98	.....	261.12	.....	Do.
Quillou	5	5	.....	1	.....	.....	.....	.....	Do.
Canephora	8	8	.....	4	.....	.....	.....	.....	Do.
Congo	9	9	.....	3	.....	.....	.....	.....	Do.
Uganda	4	4	.....	2	.....	.....	.....	.....	Do.
Abeocuta	37	31	14	14	.....	.....	.....	.....	Do.
Total	522	509	263	298	531.74	161.45	.....	.....	

Comparison cannot very well be established between the yields given in the above table since the trees of the different varieties were planted at different times.

The average yield per tree of the Excelsa coffee is 4.77 kilos berries; Liberian, 3.31 kilos; and Dybowskii, 0.05 kilo.

At La Carlota.—From the old coffee trees 27.99 kilos of cleaned seeds have been harvested already. Replanting of the vacant hills was done, and the Panama-hat palm field No. 2 has been interplanted with coffee planted in the station covering an area of 4.57 hectares, Excelsa, 227; Abeocuta, 134; Bukobensis, 14; and Liberian, 237. The plants are in good condition.

Viability test at Lamao.—The results obtained so far indicate that moist charcoal, moss, and sand are the good preservative materials for coffee seeds. The seeds preserved in dry stages such as in bottle, cloth bag, dry sand, and moss, empty can and seed envelope only germinated during the first three months, while those seeds preserved in moist moss, charcoal, and sand gave 86, 46, and 50 per cent germination, respectively, after six months.

Propagation of cacao at Lamao.—Thirty-seven plants of a red variety of cacao received from the Singalong Propagation Station have been interplanted between the tropical trees during the year.

ROOT CROPS

Variety test of sweet potatoes at Lamao.—The 1923 culture is still in progress. The following table shows the results obtained from the different varieties included in the last year's planting but harvested during May and June of this year:

TABLE LXVIII

Perm. No.	Variety name	Computed yield per hectare
		Kilos
7342	Check (Jersey Red)	
	Toguicao	4,706
	Tarlac No. 2	9,906
	Check (Jersey Red)	
6671	Samar Big Yellow	10,806
7923	Tabao	11,886
7539	Shanghai	578
	Check (Jersey Red)	
	Blo	3,116
	Guinobatan No. 2	7,688
	Guinobatan No. 1	6,686
	Check (Jersey Red)	
7482	Linoco	3,302
	Los Baños	1,334
	Sheally	2,410
	Check (Jersey Red)	

Tabao, Samar Big Yellow, Tarlac No. 2, and Guinobatan No. 2 gave the highest yields per hectare in the order of their enumeration.

Distance of planting and ridge vs. Furrow planting of sweet potatoes at Lamao.—The following table gives the results of the distance of planting and ridge vs. furrows planting of sweet potato:

TABLE LXIX

Perm. No.	Variety name	Furrow planting			Ridge planting			Difference in yields in favor of furrow planting at 1 × 1 meter distance
		Computed yields per hectare			Computed yields per hectare			
		1 × 1 meter	1 × 0.8 meter	Difference of the yields	1 × 1 meter	1 × 0.8 meter	Difference of the yields	
		Kilos	*Kilos*	*Kilos*	*Kilos*	*Kilos*	*Kilos*	*Kilos*
7342	Check (Jersey Red)							
	Teguicao	5,684	6,136	552	3,968	3,320	648	1,216
	Tarlac No. 2	15,728	4,512	11,216	11,368	10,280	88	4,360
	Check (Jersey Red)							
6671	Samar Big Yellow	17,904	13,744	4,160	4,760	9,120	2,360	11,144
7923	Tabao	14,324	16,208	1,884	10,016	8,360	1,650	4,308
7539	Shanghai	1,480	328	1,152	400	544	144	1,080
	Check (Jersey Red)							
	Check (Jersey Red)							
	Bio	2,496	2,032	464	3,856	4,688	832	1,360
	Guinobatan No. 2	7,632	7,752	120	6,504	8,800	2,296	1,128
	Guinobatan No. 1	6,616	5,024	1,586	7,608	7,952	344	992
	Check (Jersey Red)							
7482	Lineco	1,992	4,224	2,232	3,296	4,208	912	1,304
	Los Baños No. 1	2,336	648	1,686	544	1,304	760	1,792
	Sheally	1,736	3,512	1,776	2,808	1,816	992	1,072
	Check (Jersey Red)							

In furrow planting at a distance of 1 x 1 meter apart; Samar Big Yellow, Tarlac No. 2, and Tabao gave the highest yields in the order of their enumeration, and in 1 x 0.6 m. the Tabao first, Samar Big Yellow, second, and Guinobatan No. 2, third.

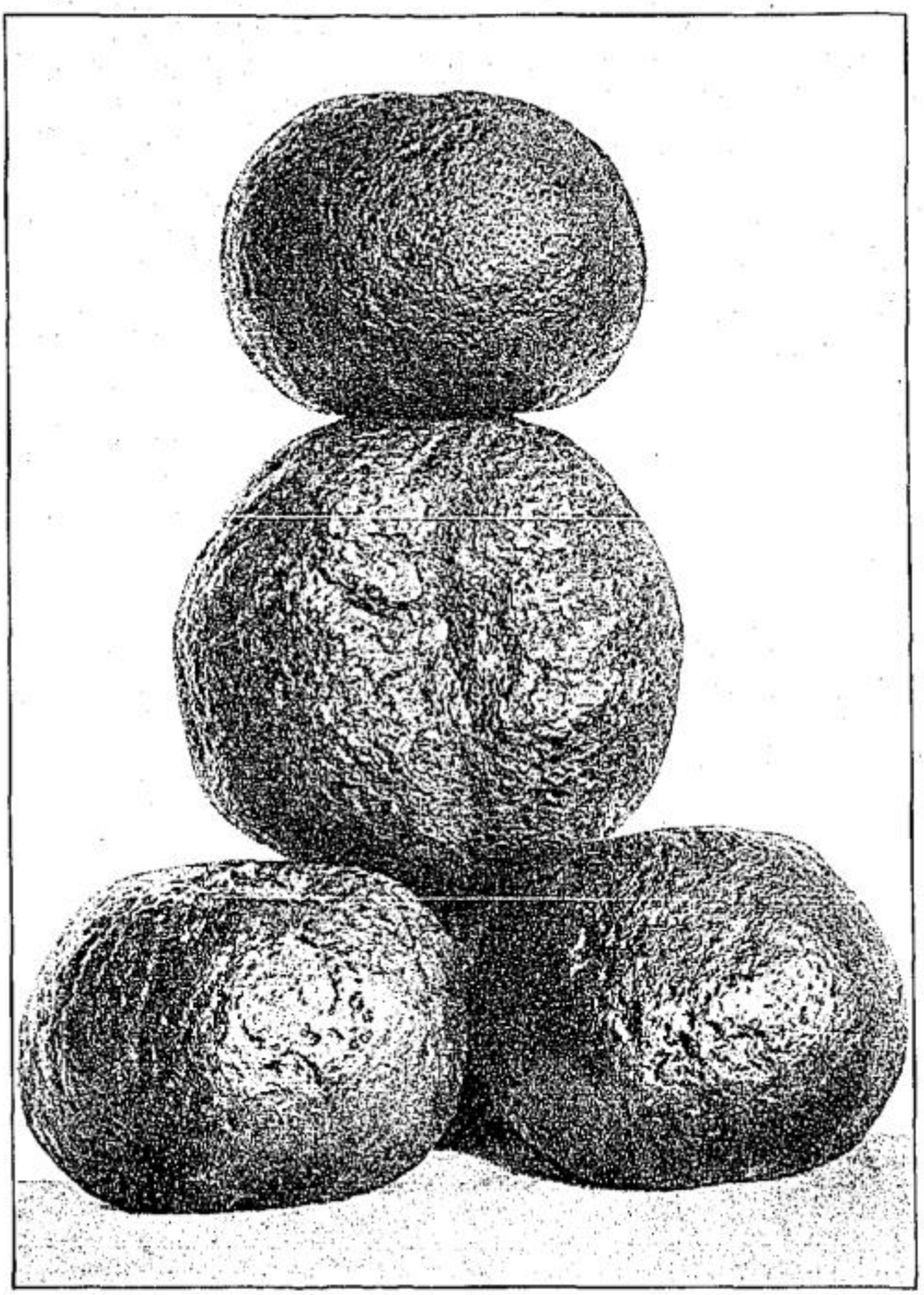
In ridge planting at a distance of 1 x 1 meter, Tarlac No. 2 was first; Tabao, second; and Guinobatan No. 1, third; and at a distance of 1 x 0.8 meter, Tarlac No. 2 was first, Samar Big Yellow, second; and Guinobatan No. 2, third.

Comparative yield of base, middle and tip cuttings of sweet potato at Lamao.—This experiment was carried along with the propagation work. It includes four varieties, namely, Georgia Yellow Yam, Jersey Red, Guinobatan No. 1, and Chinese. The planting was done on June 18–20, 1923, at a distance of 1 x .4 meter apart. The experiment is still in progress, and only few hills were harvested in December.

The following table shows the preliminary results on yields of the different cuttings:

TABLE LXX

Variety name	Computed yield per hectare in kilos		
	Base cuttings	Middle cuttings	Tip cuttings
Jersey Red	3,500	2,833	6,917
Georgia Yellow Yam	2,750	1,833	6,000
Guinobatan No. 1	3,650	3,750	25,500
Chinese	6,916	36,333	17,333



Mandarin oranges from China infected with black spots (*Phoma citricarpa* McA.)

The tip cuttings generally yielded the highest except in the case of the Chinese variety. With this variety, middle cuttings gave the highest yield.

Propagation of sweet potatoes at Lamao.—During the year an area of 0.192 hectare of ground have been planted to four of the best varieties of sweet potatoes at the station for distribution.

VARIETY TEST OF CASSAVA AT LAMAO

1. Area of field	0.568 hectare.
2. Area of individual plots	Varies according to the materials available for planting—31.2 to 286 square meters.
3. Number of check plots	2.
4. Spacing	1 x 1.2 meters apart.
5. Amount planted	3,141 cuttings.
6. Date of planting	May 27, 31, 1923.
7. Cultivation, frequency	When necessary.
8. Cultivation, method	Animal-drawn cultivator and supplemented by hoeing.
9. Date of harvesting	December 12, 1923.
10. Computed expenses per hectare	₱211.89.

The following table shows the results of this test:

TABLE LXXI

Perm. No.	Variety name	Computed yields in kilos	
		1922	1923
	Check (Red Manila)	.....	.....
7452	Sipin Valencia	62,500	22,400
7449	Agati	31,200	34,529
7444	Magsino	168,600	25,508
7448	Isidro	24,800	24,704
	Red Native	16,100	19,000
7447	Sinkong Mania	48,900	27,758
	Jolo Red	.....	25,970
	Jolo White	53,000	43,516
7457	Kapo Colorado	53,700	13,791
6563	Rough Internode	43,500	17,233
7454	Angular	20,600	12,725
7458	Kapo White	49,600	12,716
7453	White Smooth	53,200	14,400
6565	Colored or Red	49,400	18,050
	White Native	11,100	14,625
	Baguit	10,300	26,545
7463	Baker	65,800	24,050
7445	Salinas	48,600	21,441
	Cassava V. F.	21,000	16,683
	Cassava White	20,400	16,758
7455	Mandioca Basirao	65,200	17,550
	Check (Red Manila)	.....	.....

From the above table it may be interesting to note that the variety Magsino gave the highest yield in 1922, and in 1923, Jolo White led the harvest.

Comparative yields of planting base, middle, and tip cuttings of cassava at Lamao.—The following table shows the comparative yields of the different cuttings:

[a] Harvested earlier because of the damage done by the flood.

TABLE LXXII

Perm. No.	Variety name	Computed yields per hectare in kilos		
		Base cuttings	Middle cuttings	Tip cuttings
	Check (Red Manila)			
7452	Sipin Valencia	25,506	29,573	11,800
7449	Agati	27,296	30,313	17,766
7444	Magsino	33,086	27,453	14,066
	Red Native	20,656	18,033	11,333
	Baculf			
7447	Sinkong Manis			
	Jolo Red			
7457	Kapo Colorado	12,223	15,020	17,713
	Jolo White	45,160	22,426	51,200
6563	Rough Internode	19,396	17,140	14,026
7454	Angular	13,236	22,126	12,523
7458	Kapo White	18,410	12,846	8,286
7453	White Smooth	11,316	17,900	7,283
6565	Colored or Red	14,090	25,086	10,213
	White Native	11,939	17,606	10,110
7463	Baker	20,436	23,460	18,673
7445	Salinas	21,610	9,313	12,570
	Cassava V. F	22,116	11,833	11,466
	Cassava White	16,623	7,020	8,363
7455	Mandioca Basirao	15,796	10,873	21,260
	Check (Red Manila)			

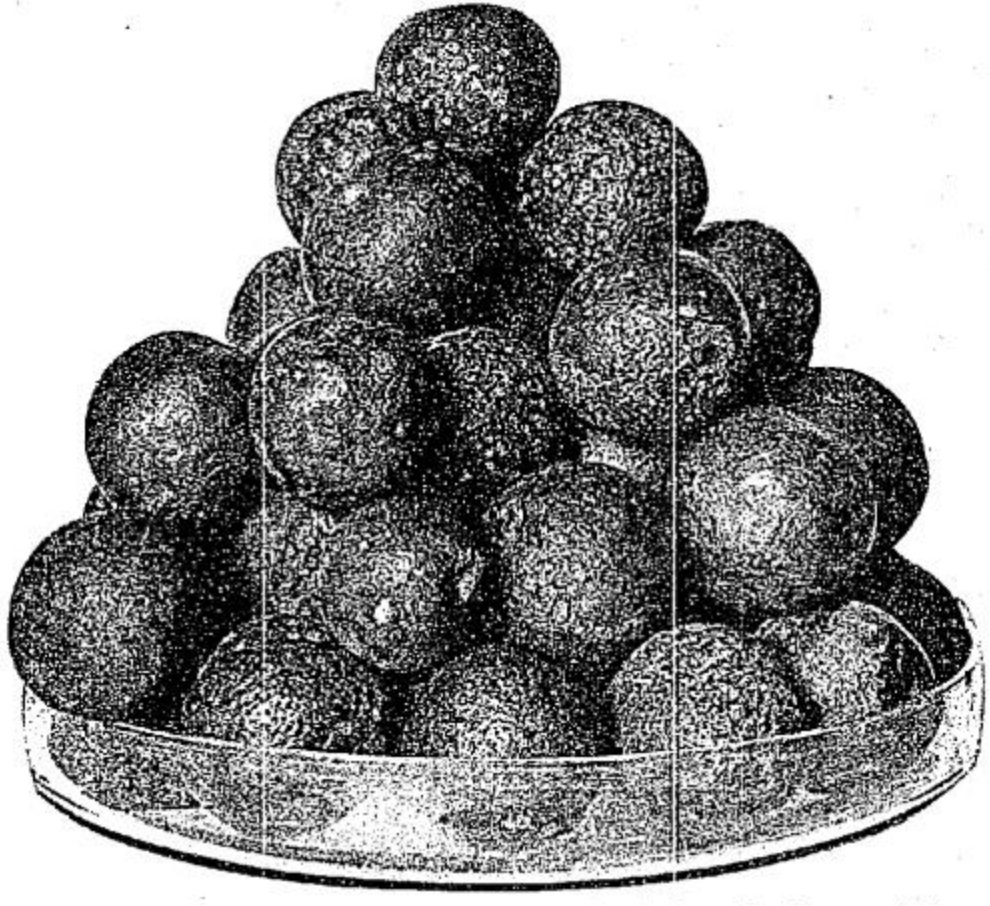
The results show that the base cuttings generally produced the higest yields excepting in Agati, Sipin Valencia, Kapo Colorado, Angular, White Smooth, Colored or Red, White Native, Baker, and Isidro varieties, whose yields from the middle cuttings exceeded those of the base cuttings.

In the case of tip cuttings only the Mandioca Basirao exceeded the yields of both base and middle cuttings.

Slanting vs. Erect planting of cassava cuttings at Lamao.—A row of each variety was planted erect or perpendicular and another row in a slanting position. The following table gives the results of the experiment:

TABLE LXXIII

Perm. No.	Variety name	Computed yields per hectare in kilos		
		Slanting	Erect	Difference
	Check (Red Manila)			
7452	Sipin Valencia	29,573	22,720	6,853
7449	Agati	30,513	65,206	34,696
7444	Magsino	27,453	33,026	5,573
	Red Native	18,033	26,666	8,633
7448	Isidro	27,726	28,510	783
	Baculf			
7447	Sinkong Manis			
	Jolo White	22,426	53,280	32,853
	Jolo Red			
7457	Kapo Colorado	15,020	17,200	2,180
6563	Rough Internode	17,140	20,366	3,226
7454	Angular	22,126	23,666	1,540
7458	Kapo White	12,846	11,300	1,546
7453	White Smooth	16,900	22,066	5,166
6565	Colored or Red	25,086	22,433	2,653
	White Native	17,606	18,800	1,193
7463	Baker	23,460	37,166	13,706
7445	Salinas	9,313	42,200	32,885
	Cassava V. F	11,833	21,233	9,400
	Cassava White	7,020	34,933	27,913
7455	Mandioca Basirao	10,873	21,966	11,093
	Check (Red Manila)			



Satauma oranges from China seriously infected with citrus canker (*Pseudomonas citri*)

From the results contained in the foregoing table, the erect or perpendicular planting generally yielded heavier harvests and produced earlier crops. Only in the case of varieties Sipin Valencia, Kapo White, and Colored or Red where the slanting position have exceeded the yields of those planted by the erect system.

Preliminary test of the comparative yields of yams at Lamao.—The field was badly damaged by flood and it became necessary to harvest many of the varieties before the crop reached proper maturity. The following table gives the results of the experiment:

TABLE LXXIV

1. Area of field	1,815.3 square meters.
2. Number of check plots	Three.
3. Date of planting	April 16, 1923.
4. Method of planting	Direct in hills and ridges.
5. Spacing	1.20 x 1 meters apart.
6. Irrigation, frequency	Once.
7. Irrigation, method	In furrows.
8. Cultivation, frequency	Three times.
9. Cultivation, method	By plow and supplemented by hoeing.
10. Date of harvesting	November 23–26, 1923.

Variety name	Computed yields in kilos per hectare	Variety name	Computed yields in kilos per hectare
Check (1011)	.....	L–2	1,519.22
U–4	2,664.10	3294	5,961.53
1057–A	5,403.84	5791	3,418.80
4678	1,942.30	1039–4	510.68
U–14	3,196.67	1057	.....
4258	3,196.67	T. L. E. S. No. 1	1,519.22
1030 Tugui	1,188.03	1014	3,395.47
El Caton	1,188.03	1059	.....
1817	3,273.50	6940	.....
1010	2,553.41	4–8	2,277.77
1037	2,314.10	U–2	.....
1057–5	3,194.44	U–3	.....
Akang	2,455.12	Asingapan 1	3,797.01
1012–A	2,672.65	U–5	3,805.55
No. 1	1,871.79	U–9	3,797.01
Uba	1,126.05	U–6	1,051.28
L–3	2,940.17	U–10	1,051.28
1011–M	1,600.42	8–10 Sel	3,433.76
Lacomo	583.33	1017–B	3,711.53
1017	1,194.44	1016	4,457.26
U–11	2,173.07	U–12	1,771.36
U–17	5,354.70	U–13	8,603.97
Check (1011)	2,709.40	1057 A. M	4,938.03
6916	2,346.15	U–15	5,316.23
1015	3,448.71	U–1	3,217.97
4000	2,081.19	Check (1011)	.....
6916–A	2,724.35		

The five best yielding varieties are U–13 No. 3294, 1057–A, U–17, and U–15 in the order of their enumeration. All of these varieties yielded over 5,300 kilos of tubers each.

Propagation of yams at Lamao.—Of the propagation of ube last year out of the eleven varieties 62.10 kilos of tubers were

harvested. All of these tubers were planted for the multiplication of the varieties.

Production of arrowroot at Lamao.—An area of 406.9 square meters of ground is being maintained for the culture of arrowroots.

Variety test of gabi and yautia at Lamao.—These crops were planted between the rows of bananas. The following table gives the results obtained in this culture:

TABLE LXXV

1. Area of field..... 889 square meters.
2. Date of planting..... May 15, 1923.
3. Methods of planting..... Direct in ridges.
4. Spacing..... 1 x .7 meter apart.
5. Cultivation, frequency of..... Once.
6. Cultivation, method of..... Hoeing.
7. Date of harvesting..... January 9, 1924.
8. Expenses per hectare..... ₱298.22.

Variety name	Computed yields in kilos per hectare	Variety name	Computed yields in kilos per hectare
Gabi No. 4	7,830.81	Yautia 6550	2,756.04
Semet	6,343.78	Sangao 7484	2,427.60
Tanay Gabi	5,973.80	Katibe	2,076.80
Yautia	2,957.40	Unknown (B)	1,428.50
Leyte White	3,909.36	Igorrot	1,235.38
Palawan		Canton China	15,714.27
Yautia 6560	3,081.33	Unknown Gabi (C)	3,571.44
Unknown (A)	2,854.80		

The five varieties giving the highest yields in the order of their enumeration are: Canton China, Gabi No. 4, Semet, Tanay Gabi, and Leyte White.

VEGETABLES

Acclimatization work at Lamao.—The following vegetables were tried during the year:

From the United States.—Carolina Bradford and Pride of Georgia watermelon; Honey Dew melon; Rocky Ford, Knight, Golden Lime, Tip Top, Ford Rock, Emerald Gem, Sweet Meat and Wood's Perfection cantaloupes; and Arlington Extra Early cucumber. The culture of these crops is in progress, and some of the plants are now in flower. The cantaloupes were attacked by downy mildew, and as a result of this many died before they produced fruits.

From China.—Two varieties of *Phaseolus aureus*, eight of *F. vulgaris*, one of *P. angularis*, and two of *Vigna sinensis* var.

aesquipedalis. All plants died before they produced mature pods except *Vigna sinensis* var. *sesquipedalis,* but this was discarded from further test because of its inferiority to the native varieties.

The chayote, *Sechium edule* plants planted during the latter part of last year have grown very successfully but only one fruit was produced from the plants. This was planted to reproduce the variety but it failed to germinate. Efforts were made to propagate the chayote by cuttings but none of the cuttings produced any roots.

TABLE LXXVI.—*Fertilizer test of raddish at Lamao*

1. Date of planting..... November 28, 1922.
2. Date of germination..... December 1, 1922.
3. Method of planting..... Drilled in furrows.
4. Spacing ..... Row 60 centimeters apart.
5. Date of application of fertilizer..... November 27, 1922.
6. Method of application of fertilizer..... Broadcasting in furrows.
7. Method of irrigation..... Flooding.
8. Method of cultivation..... Planet Junior cultivator supplemented by hoeing.
9. Date of harvesting..... January 19, 1923.
10. Computed expenses per hectare..... ₱133.92.
11. Area of each plot..... 16.64 square meters.

Kind	Fertilizers used	Number of roots		Computed yields of roots and leaves in kilos per hectare	Computed yields of roots per hectare
	Amount per hectare	Marketable	Not marketable		
	Kilos				*Kilos*
Cow manure	25,987.50	178	287	28,894.23	10,961.52
Dried blood	943.50	212	299	42,487.98	16,646.63
Sulphate of potash	400.86	141	103	29,567.30	9,915.85
Tankage	1,135.81	139	219	33,750.00	13,461.53
Ammonium sulphate	468.75	1,177	243	41,586.53	8,633.65
Acid phosphate	8,353.36	135	128	27,884.61	9,915.86
Treble superphosphate	318.50	71	92	12,980.76	4,807.69
Fertilizer No. 1 (N. 3.15%, P_2O_5, 08% and K_2O 4.11%)	625.00	145	162	34,495.19	11,177.88
Fertilizer No 2 (N. 1.83% P_2O_5 11.93% and K_2O 2.31%)	625.00	180	132	45,672.95	17,512.01
Ash	3,088.94	170	178	31,971.15	10,937.50
Check	.....	104	154	20,312.50	6,370.19

From the above table the following results may be deduced: Dried blood gave the greatest number of marketable roots; fertilizer No. 2, second; and cow manure, third.

Concerning the yield of roots and leaves fertilizer No. 2 gave the greatest yield; dried blood, second; and ammonium sulphate, third.

In the yield of roots alone, fertilizer No. 2 was first, dried blood, second and tankage, third.

Preservation of Tomatoes at Lamao.—This experiment was begun on May 21, 1923. Ripe and matured fruits of native tomato were used in this experiment. They were divided into six portions, each portion consisting of matured and ripe fruits, placed in air-tight jars. They were subjected under the following conditions:

1. Without any preservative material in bottle.
2. In acetic acid solution of about 1 per cent strong.
3. In layers of salt.
4. In layers of air-slaked lime.
5. In sugar solution (sweet to the taste).
6. Without any preservative material but boiled for 10 minutes in water before preserving.

The fruits under condition 2 remained good up to December 31, 1923; under condition 4 for 16 to 19 days; under condition 1 for 9 to 19 days, under condition 3 for 7 days, and under conditions 5 and 6 for 4 days.

Under condition 3, the fruits wrinkled.

Under conditions 5 and 6 the fruits softened and decayed.

Seed propagation of vegetables at Lamao.—Only the important varieties of vegetables are being propagated for seed purposes. Seven thousand eight hundred twenty-four (7,824) square meters of ground were planted to eggplant, squash, upo, patola, watermelon, and pakupis during the year.

Propagation and selection of pole beans at Lamao.—Eight varieties of pole beans are under trial, covering an area of 5,479.2 square meters of ground.

MISCELLANEOUS HORTICULTURE

Banana.—Average number of suckers produced per hill—8109 Klum was first with 12 suckers; 9159 Boracho and 8100 Tarnate, second with 9 each; 8148 Dool, 8129 Num Keep Dum, and 8110 Chuoi Hot, third with 8 each; Toybol and 8121 Chuoi La, fourth with 7; 8157 Klang Paya Sao, 8150 Ideep, 8175 Rodoc Calm, Nos. 7 and 9 unidentified, fifth with 6; and No. 10 unidentified, 8085 Alisang, 8092 Liparot, New Guinea Sugar, 8153 Dkum, 8180 Gapis, 8166 Musal Nanka, and 8173 Susu Petri, seventh with 5 suckers each. The other varieties produced from 1 to 4 suckers during the year.

Propagation of papaya at Lamao.—As in the previous years only the good varieties or strains of papaya were planted for

seed purposes. Five hundred fifty-three seedlings of seven varieties or strains of papaya have been transplanted on the different fields during the year. However, the majority of the plants planted died because of excessive rains.

The following table shows the yields of the varieties in fruits and the total number of trees of each variety.

TABLE LXXVII

Variety name	Number of trees		Bearing trees		Yield in number of fruits			Remarks
	1922	1923	1922	1923	Actual	Average	Computed per hectare	
Hawaiian	30	282	30	13	873	67	74,437	80 trees were blown down by storm.
Pointed type	4	54	4	4	223	55	61,105	51 killed by flood.
Round Solo	4	9	3	3	219	73	81,103	6 killed by flood.
Brazilian	.....	90	.....	.....	.....	.....	.....	65 killed by flood.
Dapitan	.....	70	.....	.....	.....	.....	.....	All killed by flood.
Lamao Long type	.....	47	.....	.....	.....	.....	.....	Do.
Long No. 1	.....	39	.....	.....	.....	.....	.....	Do.

It must be understood that nearly all the bearing trees of papaya are still producing marketable fruits. From the yield obtained so far Hawaiian papaya produced from 28 to 108, Pointed from 35 to 74, and Round Solo from 68 to 79 fruits.

As to the average production per tree, Round Solo papaya was first with 73 fruits; Hawaiian, second with 67 fruits; and Pointed third, with 55 fruits.

As to yield per hectare basing on the average production and a spacing of 3 x 3 meters apart, and excluding the males produced, Round Solo gave a production of 81,103 fruits; Hawaiian, 74,437 fruits; and Pointed, 61,105 fruits per year.

Effect of sunlight on the germination of papaya seeds at Lamao.—The result of this experiment may be stated as follows: The vitality of papaya seeds is destroyed by an excessive sunlight while seeds placed under the shade lay dormant for a long time. A limited amount of sunlight is, therefore, necessary for the germination of papaya seeds.

Extraction of papain from fruits of Hawaiian papaya at Lamao.—The latex of the fruits in each tree were extracted at different times so as to determine the best time of extraction, and the amount of papain obtainable from an individual fruit. The results obtained in this experiment are given in the following table:

TABLE LXXVIII

Tree No.	Number of fruits	Date of extraction	Time of extraction	Weight of papain	Average weight of papain per fruit	Remarks
				grams	*grams*	
1	27	4–6–23	7 a. m.	8.0	.29	Juice did not coagulate easily.
2	15	4–12–23	7 a. m.	5.0	.33	Do.
3	32	4–9–23	7 a. m.	6.0	.18	Do.
4	21	4–16–23	7 a. m.	5.0	.233	Do.
1	27	4–12–23	10 a. m.	2.0	.074	Juice coagulated easily.
2	15	4–6–23	10 a. m.	6.0	.4	Do.
3	28	4–12–23	10 a. m.	4.0	.14	Do.
4	21	4–9–23	10 a. m.	4.0	.19	Do.
1	27	4–9–23	1 p. m.	1.0	.037	Juice did not coagulate easily.
2	14	4–16–23	1 p. m.	1.0	.071	Do.
3	32	4–6–23	1 p. m.	1.0	.031	Do.
4	21	4–12–23	1 p. m.	2.0	.09	Do.
1	27	4–16–23	4 p. m.	3.0	.11	Juice coagulated easily.
2	15	4–9–23	4 p. m.	1.0	.06	Do.
3	28	4–12–23	4 p. m.	3.0	.10	Do.
4	21	4–6–23	4 p. m.	5.0	.238	Do.

From the results it can be seen that the greatest amount of juice was obtained at 7 a. m.

The effect of different methods of preparation of papaya seed at Lamao.—From the results obtained, it shows that the best method of preparing papaya seeds in order to get the highest percentage of germination is to dry the seeds at room temperature without removing the coating adhering to the seeds.

Propagation of papaya by cutting at Lamao.—Branch cuttings of papaya were obtained and planted in fine sand under the nursery shed. Before planting all the leaves were removed by cuttings at the middle of the petioles. The results indicate that papaya can be grown by means of cuttings but it is not certain yet whether such method of propagating papaya is practicable or not in a commercial way.

Effect of cutting papaya stems at different ages at Lamao.—To determine whether or not it is possible to rejuvenate papaya tree. Papaya plant of different ages were selected and the growing points were cut off. The results show that young plants of about 3 to 8 months old recovered easily from the injury made, and trees of about 2 or more years although they produced new sprouts yet were incapable of producing marketable fruits.

Propagation of pineapple at Lamao.—Nineteen varieties of pineapple are being propagated at the station. These include three native varieties that will be used for breeding work. About 1.45 hectares of ground planted to Hawaiian pineapple is also being maintained for distribution purposes.

Segregation of the late maturing Hawaiian pineapple plants at Lamao.—Aside from the main crop produced by the Hawaiian pineapple, a secondary crop was also produced from October to December. The latter crop was about one-seventh of the main

crop. Segregation was done by planting the crowns, slips or suckers produced by the late maturing plants.

Comparative yields of rima at Lamao.—There are 64 rima trees maintained at the station but only 13 trees are bearing at present.

The following table gives the yield of the individual trees during the year (twice bearing):

TABLE LXXIX

Tree No.	Date planted	Number of fruits harvested
1	1914	89
2	1914	128
3	1914	88
4	1914	86
5	1914	85
6	1914	103
7	1914	82
8	1918	18
9	1918	54
10	1918	12
11	1918	21
12	1914	65
13	1914	118

Chico variety test at Lamao.—Forty-five seedlings of P. I. No. 7704 and 7350, and 10 marcotted plants were transplanted on September 24–27, 1923.

Variety test of miscellaneous horticultural crops at Lamao.—Several species or varieties were set out in a more or less extensive way.

The following shows the number of plants set out of each species or varieties and the date of planting:

TABLE LXXX

P. I. No.	Variety name	Date of planting	Number of trees	Remarks
	Guanabano	June 14–19, 1923	100	Planted between the mangoes.
	Custardapple	August 10–15, 1923	108	Do.
	Sugarapple	August 16–18, 1923	101	Do.
	Biriba (budded)	August 25, 1923	48	Do.
	Atemoya (budded)	August 25, 1923	19	Do.
7795	Tiesa	August 21, 1923	20	Planted between the marange.
3935	do	do	10	Do.
7545	Calmito	August 24, 1923	22	
7595	do	do	23	
7596	do	August 27, 1923	22	
7585	do	do	21	
7709	do	do	9	
	Marang	August 21–23, 1923	101	
	Lemasa	August 4–5, 1923	99	
	Kayam	September 6–8, 1923	71	
7699	Lanzon	September 18, 1923	24	Planted between the calmitos.
7796	do	do	6	Do.
	do	do	24	Planted between the lemasa.
-	Cacao	September 15, 1923	37	Planted between the kayam.
	African oil palm	do	15	

The above plants generally made a good growth except a few which have died.

Vegetative propagation experiments at Lamao.—Vegetative experiments form one of the most important phases of the work

under miscellaneous horticulture. Budding, grafting, marcotting, and propagation by cuttings have been tried with various tropical trees.

Top-working at Lamao.—Top-working is being tried on various tropical trees that are poor bearers and of fruits having poor quality and flavor. These trees were: Three carambola trees, one duhat, two camias, and two mabolos. The duhat and one of the mabolo trees were partially top-worked. The sprouts of the carambola and camias were shield budded with the sweet varieties of the same species. The sprouts produced from the duhat and the entirely top-worked mabolo are not yet ready for budding or grafting. The sprouts of the partially top-worked mabolo have recently been budded and grafted with the scions of the seedless variety.

Viability test of fruit tree seeds at Lamao.—Four kinds of preservative materials were used, namely, sawdust, soil, charcoal, and moss. Bottles with glass stoppers and bamboo tubes were used as containers. The results are as follows:

Berba seeds preserved in moist sawdust gave 64 per cent, in moist moss, 40 per cent and in ordinary cloth bag 40 per cent after 98 days. After this time the berba seeds gave very low germination.

Alpay seeds preserved in moist charcoal gave 40 per cent germination after one month while in another medium it gave zero per cent.

Moist charcoal and moist sawdust gave 100 per cent germination with the lanzon seeds after 33 days as compared with 80 per cent of the seeds without any preservative materials. It is rather noticeable after 16 days that seeds preserved in sawdust and charcoal have exhibited lower percentage of germination than the second sowing. The soil medium has proven to be very poor since the beginning of the experiment.

Acclimatization of miscellaneous fruit trees.—The following table shows the summary of the plants in the acclimatization test plots of the different stations:

TABLE LXXXI

Items	Lamao, total		Increase	La Carlota, total	Bontoc, total
	1922	1923		1923	1923
Species	195	207	12	62	24
Varieties	243	258	15	68	62
Trees	883	1,025	142	225	141
Area in hectares	4.04	4.54	0.5	3.29	1.9

The work at Bontoc consists principally of the acclimatization test of semi-temperate fruit plants, and the trials of several lowland fruits like the mango, annonaceous, etc. At this station the soil where the acclimatization plots were located is rather stony and poor. Attempt has been made to fertilize the trees with manure at the rate of 4,000 kilos per hectare. By the use of this fertilizer the trees generally became healthy and with vigorous growth.

Several pests and diseases were found to attack the fruit trees at Bontoc. The most dangerous pest is a certain beetle which attacked the apples, mangoes, and other fruit tree seedlings. The beetles are doing a considerable damage to the fruit trees by girdling the branches. A fungus disease is affecting the peaches to a considerable extent. The disease is characterized by a thick and yellowish fluid coming out from the affected bark. The common place of attack is at the base of the trunk and large limbs.

OTHER HORTICULTURAL ACTIVITIES

Exploration works.—Two new types of mangoes have been found in Bulacan. One is known locally as "kabayo," and is long and slender with a rough surface and very sweet. The other type, called "morado," is similar to the pico, the surface is reddish and the flesh is sweeter and of a better flavor than the ordinary pico.

Many mango trees have been located which have a high reputation locally for productivity and general excellence. Several mandarin, orange, and pummello trees reputed to bear superior fruits have also been located.

A spontaneous *Citrus hybrid* of exceptionally vigorous growth locally known as sigara has been discovered in Batangas and is being propagated as of possible value as a stock for other citrus fruits.

Coöperative trial tests.—A coöperative variety fruit orchard has been started in Calauang, Laguna, which will include a considerable number of durians and marangs. Besides this a coöperative trial planting, especially of the introduced varieties of citrus, coffee, and miscellaneous fruit trees, has been started on the various fruit-producing provinces. The following table indicates the progress of this work:

TABLE LXXXII

Province	Number of coöperators	Number of plants		
		Citrus	Coffee	Miscellaneous fruits
Batangas:				
Santo Tomas	8	46	400	.....
Tanauan	20	145	500	.....
Malvar	11	45	350	.....
Lipa	12	38	2,375	.....
Tallsay	2	.....	1,140	.....
San Jose	1	.....	87	.....
Rosario	2	.....	1,500	.....
Cavite:				
Indang	5	.....	132	64
Naic	1	.....	50	.....
Amadeo	3	.....	68	.....
Alfonso	1	.....	20	.....
Laguna:				
San Pablo	11	.....	4,732	270
Nagcarlan	.....	.....	2,040	75
Biñang	1	.....	60	.....
La Union	.....	44	.....	232
Rizal:				
Caloocan	1	4,000	.....	.....
Cainta	1	249	.....	102
Total	80	318	18,303	743

Trial plantings of Robusta and Excelsa coffee have also been undertaken in several towns in Albay.

An extensive rejuvenation work has been performed on the mandarin trees in the various municipalities of Batangas Province. Old, diseased, and unproductive trees were top-worked and budded or grafted with known strains of citrus either selected locally or from the introduced varieties grown at Lamao and Tanauan stations. There are 23 coöperators in the municipality of Malvar, 32 in Tanauan, and 22 in Santo Tomas.

In Baguio the chayote has been found to thrive well and there is no doubt but that it is only a question of time when this will become an important vegetable there.

At the Agricultural School in Lapak, Siasi, the Kamili, *Coleous retundifolius*, has produced a crop of tubers which, while they are small, are reported to have a good nutty flavor, and to some extent may become of value as a root crop.

The *Talinum triangulare*, a vegetable introduced from Java in 1914 is gradually winning favor in many parts of the Islands especially among the Americans.

The American persimon and *Actinida chinensis* have been successfully introduced in the Mountain Province.

In Cebu a pitanga, *Eugenia uniflora*, seedling originally distributed by this Bureau has been found to be everbearing and is being propagated by grafting for general dissemination.

In 1917 a large collection of new fruit trees were sent to the provincial nursery in Jolo, Sulu, and on inspection this year showed that 26 species are well established and thriving there. Several trees have already come into bearing. The biriba had

made an astonishing growth both on its own roots and budded on the guanabano. The kanari and kubili trees had also made exceptionally good progress, so as the kami *Cinnammum mindansense*.

The avocado fruit has attracted the attention of many of the Negros people and of other provinces. The atemoya and Lemasa are also gaining their popularity.

Miscellaneous investigations.—Generally, there is a wide interest in better methods of drying copra, and various models have been installed in different parts of the Islands during the past three years. One of the most notable is the polo copra drier, invented by Mr. H. J. Detrick, manager of the Polo and Pamplona Coconut Plantations, Oriental Negros. This is an inexpensive drier. The cost of construction is about ₱1,100 including 50 extra trays, and it has a capacity of 4,000 nuts for every 24 hours.

Another very good drier has been constructed at Patalon, Zamboanga, which is especially well adapted for use by small coconut planters, as it consists of one or more arches built of brick or stone for firing with a grill above on which to dry the copra, and has no mechanisms to get out of order. This drier has a capacity of 23,000 nuts per week and was constructed at a cost of ₱1,300.

Other field investigations on cacao, lanzon, coconut and other miscellaneous crops are in progress.

TABLE LXXXIII.—*Seed and plant materials distributed*

Kind	Quantity of materials				Value
	Fruits, seeds, or tubers		Number of plants, suckers, bulbils, rootstocks, or crowns	number of budsticks or cuttings	
	Number	Kilos			
Rice	.....	14,940.40	.....	.....	₱1,713.35
Do.	.....	6,627.764	.....	.....	727.76
Corn.....cars.	22,913	813.62	.....	.....	269.09
Sugar cane	.....	.....	.....	126,482	762.84
Tobacco	.....	57.278	22,650	.....	618.80
Forage crops	.....	0.07	10,015	39,613	163.70
Miscellaneous agronomy	.....	1,535.19	.....	.....	762.00
Citrus.....seeds.	250	13.454	2,799	2,686	1,663.10
Do.....fruits.	7,262	.....	.....	.....	.....
Mango.....seeds.	4,412	.....	300	2,617	280.29
Do.....fruits.	218	.....	.....	.....	.....
Coffee and cacao	.....	59,744	3,871	.....	504.31
Coconut and lanzon.....seeds.	980	.....	.....	.....	29.60
Rootcrops	.....	49.00	.....	18,854	73.25
Vegetables.....tubers.	227	0.05	.....	.....	1.81
Do.....fruits.	57	.....	.....	.....	.....
Miscellaneous horticulture.....seeds.	7,361	47,729	12,419	605	2,792.22
Do.....fruits.	16,699	.....	.....	.....	.....
Abaca.....do....	8	3,584	804	.....	152.18
Maguey and sisal	.....	.....	553	.....	93.60
Miscellaneous fiber crops	.....	38.61	538	.....	62.26
Total	.....	24,186.493	53,949	190,757	10,671.07

NOTE.—Seed and plant materials sold through the Agricultural Extension Division were included in the above table.

TABLE LXXXIV.—*Inventory of seed and plant materials on hand December 31, 1293*

Kind	Materials	Quantity		Value
		Kilogram	Number	
Cacao	Seedlings	.....	996	₱199.20
Citrus	Seed	2.3	.....	10.50
Do.	Seedlings	.....	13,395	1,850.25
Do.	Budded plants	.....	2,926	1,463.00
Coffee	Seed	254.79	.....	509.58
Do.	Plants	.....	9,301	930.00
Corn	Ears	.....	6,500	6.50
Do.	Feed	300	.....	27.00
Forage	Cuttings	.....	44,500	155.75
Do.	Rootstocks	.....	15,000	45.00
Maguey and Sisal	Plants	.....	585	8.75
Mango	Budsticks	.....	4,000	40.00
Do.	Plants	.....	3,698	554.70
Miscellaneous agronomy	Seeds	666	.....	666.00
Miscellaneous fiber	....do	33.41	.....	42.73
Do.	Plants	.....	38	3.80
Miscellaneous horticulture	Seeds	12	.....	80.00
Do.	Suckers and growns	.....	3,030	121.20
Do.	Plants	.....	23,813	333.83
Rice	Seed	[a]257	.....	1,028.00
Rootcrops	Cuttings	.....	33,000	165.00
Do.	Tubers	200	.....	30.00
Sugar cane	Cuttings and Points	.....	87,805	439.08
Tobacco	Leaves	3,270	.....	196.20
Vegetables	Seed	951	.....	5,706.00

NOTE.—([a]) = cavans.

RECOMMENDATIONS

The following recommendations are submitted:

1. The construction of one laborers' cottage at the Lamao Experiment Station, Lamao, Bataan, to replace the one that has been washed away by the flood.

2. The construction of concrete dikes on certain places along the banks of the Lamao River within the Lamao Experiment Station.

3. The completion of the irrigation system at Lamao as already approved by the Bureau of Public Works.

4. The construction of a concrete storage chamber for fruits, root crops, etc. at the Lamao Experiment Station, Lamao, Bataan.

5. The transfer of buildi ngsfrom the Dammao Tobacco Stati onat Dammao, Gamu, Isabela to the proposed new site at Ilagan, Isabela.

6. The transfer of the Pikit Tobacco Station at Pikit, Cotabato, to a new site at Dulawan, Cotabato.

7. The establishment of two lowland rice substations, one in pototan, Iloilo and one in the Bicol region.

8. The establishment of an upland rice substation either in Batangas or Cavite.

9. The increase in personnel doing field investigational and research work.

10. The standardization of salariesof the technical force.

PLANT PESTS CONTROL DIVISION

ORGANIZATION

Administratively, the division was divided into three sections: (1) General Service; (2) Plant Pests Section; and (3) Plant Disease Section.

(1) *General Service:*

(*a*) Plant quarantine service under which heading port and field inspection and the quarantining of plant materials are placed.

(*b*) Preparation of rules and regulations according to the recommendation of the Plant Quarantine Board for approval of the Director of Agriculture and the Honorable, the Secretary of Agriculture and Natural Resources.

(*c*) Handling of correspondence from the field and the management of personnel in the whole division.

(*d*) Enforcement of the rules and regulations of the Bureau of Agriculture regarding plant pests and diseases.

(*e*) Field inspection and reporting of outbreak of plant pests and supervising field campaigns.

These activities are under the direct charge of the chief, Plant Pests Control Division.

(2) *The Plant Pests Section* include primarily research work with Mr. F. Q. Otanes as in charge.

The work of this section will be divided into research and field inspection of important outbreaks of plant pest whenever special and quick control is necessary. The Plant Pests Section has been requested to find out the best ways of controlling the major pests of the Philippines—above all the locusts—and besides the rice bug, the army worm, the corn borer, the sugarcane borer, the coconut beetle, the abaca root borer, etc., and to study the best way of exterminating rodents, especially rats which often cause enormous losses to Philippine agriculture. Minor pests will also be dealt with.

It has been thought that beekeeping also on a small scale should be started.

(3) *The Plant Disease Section* is under the direct charge of Dr. N. G. Teodoro. The work of this section will be mainly research work in connection with our most important economic plants.

Arrangements were made by the Department of Agriculture and Natural Resources with the Bureau of Science so that the technical staff of the Plant Disease Section may continue using the office and laboratory facilities of that Bureau.

The condition as to the mutual coöperation between the division of Plant Industry and Agricultural Extension and this division is now properly defined. The Plant Industry Division was furnished with the necessary personnel to control plant pests and diseases in the experimental stations. Periodical inspections are made for diseases and pests. This was carried out in the experimental stations at Alabang, Lamao, Singalong, and La Carlota. This division also furnished the necessary instructions and the Agricultural Extension Division furnishes the men to coöperate with the work in the field such as control measures and survey work.

PERSONNEL

The following is the status of personnel during 1923:

	Number of employees				
	Technical		Clerks	Emergency employees*	Total
	Permanent	Temporary			
Employees at the beginning of the year	10	10	2	4	26
New appointees during the year	2	1	.....	35	38
Transferred from other division	.....	.....	.....	1	1
Separated during the year	.....	.....	.....	7	7
Resignations during the year	3	.....	.....	3	6
Transferred to other division	.....	.....	.....	1	1
Transferred to other bureaus	.....	.....	.....	.....	.....
Employees at the end of the year	9	11	2	29	51
Increase or decrease of personnel	1	1	.....	25	.....

NOTE.—(*) Includes locust inspectors.

ACTIVITIES

The activities of this division for the year 1923 were confined in the following:

1. Plant diseases survey.
2. Study and control of pests and diseases of all plants, especially rice, corn, sugar, pineapple, coconut, banana, tobacco, citrus, and other fruit trees.
3. Inspection and control measures of garden vegetable pests and diseases as well as other economical plants.
4. The control of locusts.
5. The control of field rats.
6. Inspection of incoming and outgoing plant materials, as well as enforcing domestic plant quarantine, fumigation, destruction, disinfectation of infected plant materials, collection and disinfection of intercepted plant pests and diseases from foreign ports.
7. Drafting administrative orders and enforcing them.

Although the locust infestation of 1923 was not as severe as in the year 1922, yet this year was characterized by the breaking out of numerous other pests and diseases prominent among which were the rice stem borer, which infested most of the

rice plantations of Cavite, Laguna, Bulacan, Tarlac, Nueva Ecija, and Pangasinan; the rice diseases of Laguna and Cavite; the root grubs on sugar cane in the Provinces of Batangas, the rice bug (*Atangia*) of La Union, the white grub feeding on miscellaneous plants around Manila and vicinities; diseases of citrus in the province of Bukidnon, the banana wilt of Laguna, the fruit fly of Bataan, the small moth borer of sugar canes of Laguna and Pampanga, etc. Generally the necessary investigations were made, and control measures given or recommended.

The locust infestation during the year started with 70 towns infested on January 1, 1923, and ended on December 31, 1923, with 51 towns infested

The allotments made by this Bureau to the different provinces from the "Contributions and gratuities" as aids amounted to ₱27,350. There is, however, a healthy balance left in the provinces for the coming year, totalling ₱46,065.38. The great amount of this fund, however, was acquired by the collection of the redemption of gratuitous work as required by section 15 of the Locust Law

In enforcing the Locust Act and waging campaign for the extermination of locusts, the coöperation of the Army was made possible through the intermediation of His Excellency, the Governor-General. The experiments of the Chemical War Service in the extermination of locusts by the use of poisonous gases has so far not given conclusive results. The aviation corps also detailed personnel and started experiments in killing locusts by dusting with calcium arsenate from an airplane assisted by one of our inspectors. The experiment was very successful. A request for the special detail of an officer who has perfected a hopper dosser has been made from the military authorities to explore the hills of Mindoro for breeding areas and dusting them with calcium arsenate provided by the Bureau of Agriculture.

The military posts were ordered to coöperate with the Bureau of Agriculture in locust control work. All available forces have been ordered to suppress the locust infestation in the reservations of Camps McKinley and Stotsenburg.

The infestation this year was not as bad as the previous year, the damage caused by the locusts amounted to only about one-half that in 1922.

The rat extermination campaign this year was carried on in the municipality of Coron, Palawan, and some towns of Pampanga by our inspectors who took with them a big supply of white arsenic which was distributed gratis and with it, instruc-

tions of how to combat this pest translated into the dialect spoken in Palawan. In other cases, instructions only were sent to individual farmers, due to the lack of inspectors.

Abaca diseases were given preferential attention during the latter part of the year to prevent the spread and to control the two serious known diseases, the bunchy top and heartrot. Two inspectors were detailed exclusively for survey work, and communications with instructions and questionaires were sent to provincial and municipal officials, teachers, rangers, and Constabulary officers, to ascertain the areas affected. Quarantine orders as well as instruction for control measures were sent to those officials also with the request that they coöperate in order to minimize the danger of the spread of the diseases. It was, however, thought better to study the diseases before any recommendation for action necessitating expenditures be submitted.

Work on coconut diseases was almost at a standstill due to lack of personnel to carry the campaign against the diseases known as "bud-rot." Efforts will, however, be made to carry on the necessary campaign early in 1924 as even new plantations in the Provinces of Laguna, Tayabas, Cavite, and Batangas as well as in the boundary of the Calamba Sugar Estate plantations were found to be so badly infected with bud-rot.

The Plant Inspection Service is constantly growing. There were 682,334 horticultural parcels inspected during 1923—exceeding that of 1922 by 112,858.

To enforce the administrative orders recently drafted which will take effect early in 1924, new buildings and equipment at Port Area, Manila, and in the ports of entry as well as the services of competent plant inspectors are required

This Office was able to secure the permission of the city authorities for the use of about three hectares of land belonging to the City of Manila for its isolation or quarantine stations and for plots where the studies of plant diseases are to be carried on.

Interprovincial quarantine on abaca and bananas from known diseases infected regions have been in force, prohibiting the movement of abaca seedlings or parts thereof from infected towns of Cavite, Laguna, Davao, and Zamboanga to other localities. More and more abaca towns are reported to be infected with the diseases. Most likely, the diseases are present in all regions especially where abaca has been grown for a long while.

The interprovincial quarantine on sugar due to the Fiji disease in the Provinces of Batangas, Laguna, Pampanga, Lamao of Bataan and San Jose of Mindoro, was lifted due to the fact

that the disease has been found, after a thorough survey, to be present in all principal sugar-producing regions.

PLANT PESTS SECTION

Insect collection.—A great deal of attention is being paid to the collection and preservation of life history materials, especially of insects of economic importance for such materials, besides being of great value to our personnel in the proper study of important plant pests, are also of value for the purpose of exhibition with the object of educating the public in our entomological work. More and more of such materials are being mounted in Ricker mounts.

Insect pests attended to during the year.—Mango fruit fly (*Dacus ferrugineous*). This insect attracted quite a deal of attention on account of the harm it did to mangos especially in the Lamao orchards of this Bureau. Two men were detailed for the purpose of studying and controlling the pest. Some important data were obtained on the life history and methods of control found not only for this fly but also for another related fly (*Dacus sp.*) which has been causing great damage to citrus and other fruits at the station.

Rice pests.—Among the insects which caused a great deal of damage during the year to rice is the stem borer (*Schoenobius incertellus*). Because of this insect in the towns of Arayat and Santa Ana, Province of Pampanga, a large amount of the rice crop this year was lost. Statements from various sources indicated that the infestation by this insect was quite general in the Province of Pampanga. This pest was also reported as being serious in the Provinces of Laguna, Rizal, Cavite, Bulacan, and Nueva Ecija.

Another rice pests which have been reported during the year are the rice case worm (*Nymphula depunctalis*), the rice leaf folder (*Cnaphalocrosis medinalis*), the cut-worms (*Prodenia litura* and *Spodoptera mauritia*), and the rice bug or "ätangia" (*Leptocorisa acuta*). Cases were investigated by our technical assistants in the Entomology Section in compliance with the calls of farmers as well as provincial and municipal officials, field and laboratory employees were detailed to make trips to those provinces, to secure important data and recommend control measures. Of all the rice pests mentioned here, the stem borer did the most damage especially in the Province of La Union. This pests was especially destructive to late rice.

Sugar-cane Pests.—White grubs did much damage in certain sugar plantations in this country during the year especially in

the Province of Batangas. Last October, our entomologist, was detailed to go to Balayan, Batangas, in response to a request from a prominent planter in that locality. The grubs in question destroyed sugar cane by feeding on the roots, causing the plant to wilt. It was found that as many as 40,000 grubs were present in a hectare of badly infested field. In a land that was being prepared for planting, as many as 14,000 grubs were present. Inasmuch as the application of chemicals is an expensive method for the control of this pest, the collection of the grubs while the land is being prepared for sugar cane was emphasized, in order to reduce the number of adults that will develop and infest sugar cane.

A paper on white grubs has been prepared and copies sent to individuals requesting information about this insect. In view of its importance as a pest, the insect is being studied at the insectary, as this pest does not confine its damage on sugar cane alone but to many other economic plants as well.

At the Singalong Propagating and Seed Testing Station, white grubs have killed 50 per cent fully of mango seedlings. Digging out the grubs and the injection of about 6 c. c. of carbon bisulphide near the base of each mango seedling proved effective methods of control. These grubs have also attacked the roots of Hawaiian pineapples quarantined for disease observation.

Moth borer of canes.—On or about March of 1923, a serious outbreak of a small moth borer on canes at Canlubang Sugar Estate was reported to this Office through the entomologist of the Bureau of Science. Inspectors were sent to investigate the situation. It was found that the infestation extended almost all over the estate and the damage done in certain fields in the Central and Santa Rosa districts of the estate was close to 25 per cent of the growing stalks. This insect was identified as *Grapholitha schistaceana* Snellen, or the "Gray borer" of sugar cane. It is also present in Java and is also considered there as an destruction pest of sugar cane.

According to the information from the manager of the estate and the field foremen, this pest was noticed some years before but they did not pay much attention as the damage done was negligible. They claim that the seeds introduced from Pampanga brought a number of this borer. In order to ascertain the validity of this claim, a plant inspector, was sent to Pampanga in May, 1923. He inspected many sugar-cane fields in many barrios of San Fernando and in the town itself. He also inspected fields in the barrio of Del Carmen of the municipality of Floridablanca. It was reported that in the barrios of San

Fernando, only a few plants showing signs of infestation similar to that in Canlubang, Laguna, were found. He was able to collect only two larvae but failed to rear any adult. In San Fernando and Carmen he saw cases of infestation but the larvae were different from those infesting sugar cane at Canlubang. Whether or not the insect is present in Pampanga which is claimed as being the source of infestation at Canlubang, is still an open question.

Other sugar-cane Pests.—The sugar-cane wooly aphids (*Oregmes lenigera*) was reported in several places in the Philippines including Negros. At the Harrison Park, Manila, this insect caused quite a large amount of damage to sugar cane. Our entomologist has found that spraying with ordinary soft, yellow Chinese soap at the rate of 1 kilo to 50 liters of water was very effective in killing the aphids without any injury to the sugar cane.

Weevils of the genus *Rhabdocnemis* were observed by one of our field inspectors damaging sugar cane at Naga, Ambos Camarines.

White ants.—The extermination of white ants which were doing considerable damage to the nurseries was affected by the use of arsenical and sulphur mixtures. Carbon bisulphide was also applied advantageously.

Miscellaneous pests.—Complaints were received from various municipalities in different provinces regarding the damage done by insects not only to such of our staple crops as rice, sugar cane, but also to coconut, abaca, cacao, coffee, etc., as well as garden and ornamental plants.

Beekeeping.—In certain countries in the Tropics such as Mexico of the Central American countries, Porto Rico, Hawaii, and Guam, beekeeping has been practiced with a certain degree of success. In the Philippines, this branch of Agriculture is as yet in a experimental stage.

With the object of starting beekeeping in the Philippines, on a much larger scale, Mr. Leo Hannegan, an American, with practical experience in the business made an effort at his own expense to obtain a fairly large number of colonies of Italian bees from the Hawaiian Islands but due to lack of space in Trans-Pacific liners he succeeded in shipping only a small number to the Philippines. This Office helped Mr. Hannegan in every way possible to take care of the bees he sent ahead from Hawaii. On June 29, 1923, twelve colonies in modern hives were received from Mr. Hannegan and these were placed at Singalong Experiment Station in charge of Mr. Otanes. When the hives were

opened it was found that more than three-fourths of the bees in each hive were dead due, no doubt, to the lack of care while in transit.

In September 1923, Mr. Hannegan arrived in Manila with four colonies of bees, but a larger number of them died too. He started to try to establish this business by himself. He took away all the bees from Singalong to San Pablo. Later he sought Government aid by offering his services in the form of partnership, afterward as employee. However, for reasons unknown to us, Mr. Hannegan decided to abandon his plan and left the Philippines after a few weeks' stay.

The bees he left—four colonies and all the equipment—were sold to this Office at far below cost. The bees are now being taken care of at Singalong under the supervision of the entomologist. The colonies are too weak, however, to give promise of success in increasing them.

In addition to these colonies of Italian bees, a colony of one of the local bees (*Apis indica*) is also being taken care of. These bees were found by Mr. Otanes building their comb in a petroleum box at Singalong, and were transferred to a modern hive.

In view of our limited personnel whose services are more greatly needed in pests control work and because of the lack of appropriation, the development of beekeeping in the Philippines by this Bureau cannot be given the attention it deserves.

Inspection and identification of specimens.—When there are big shipments of plant materials from other countries, the personnel of this section (Pest Control) has been ordered by the undersigned to help in the inspection work at Port Area.

Specimens of intercepted pests were forwarded to the Entomologist Section for identification and specimens of pests for identification and advice were received from all over the provinces. Whenever needed, instructions for control measures are given personnally by local inspectors under the direction of the in charge of the section. Otherwise letters are answered and occasionally a small quantity of insecticides or poison are given free of charge.

Rat extermination.—Supervision of the work and the actual extermination of rat has been done by this Office in some municipalities of Pampanga and in the barrios of the town of Coron, Palawan, where the rats and field mice did considerable damage. Many reports and requests for advice and help were received. Two plant inspectors of this Office, held meetings, instructed and distributed to people instructions and white arsenic gratis. The

instructions for rat control were translated into Pampango and Cuyono. There were good results from the campaigns as was proved by the actual saving of the crops threatened by this pest.

MISCELLANEOUS WORK

As usual, the Plant Pests Control Division for the whole year received calls from everywhere for advice, requesting us to furnish inspectors, equipments, insecticides and fungicides, as well as poisons to destroy any vermin, infesting houses, or gardens, shade trees and orchards. Most of the complaints were due to insects and other allied pests.

Such services were extended gratis. This work is by itself an invaluable service that the Pest Control Division is rendering to the city and suburb communities.

PLANT INSPECTION AND QUARANTINE SERVICE

During the year, the principal activities of the service consisted of the enforcement of the various administrative orders issued under the authority of legislative Act No. 3027 by this Bureau. This work consisted principally of the inspection of all fruits, vegetables, living plants, cuttings, seeds and any other plant materials coming into the Philippines from foreign countries. Inspection was undertaken in the ports of Manila, Zamboanga, Iloilo, Cebu and in all the post offices receiving plant materials. With this work, the careful inspection of plant materials consisting mainly of seeds and nursery stock intended for exportation to foreign coutries like the United States, Japan, and others, was carried on. In this connection, strict compliance with the rules and regulation of the United States Federal Horticultural Board, as well as those of other countries having plant quarantine service, was always observed.

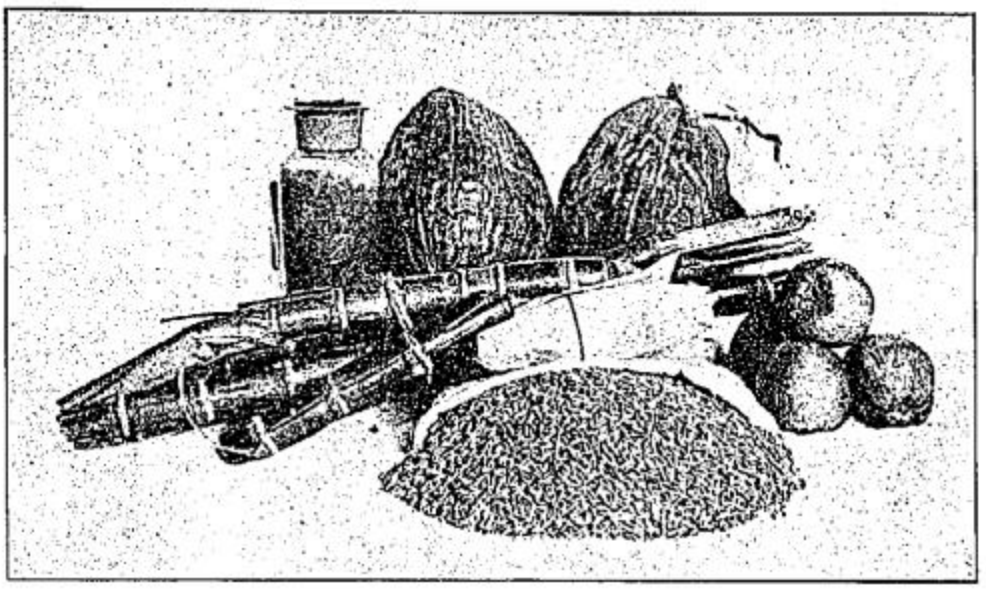
Collection of specimens of intercepted diseases and pests and the preservation of the same were also undertaken. This material is becoming more of information on plant diseases and pests which are frequently intercepted at the different quarantine stations.

Building and equipment.—The building and equipment of the service remain the same in spite of the great need of the work for better accommodations and facilities. The only building of the Manila Plant Quarantine Station, at present, 3 by 6 meters of floor space with 3 rooms which are used as fumigation room, office, and laboratory. This building is wholly inadequate for the needs of the service. In Zamboanga, and Iloilo, new fumigation boxes should be made and all other necessary equipment

should be provided because without them this work can not be carried on.

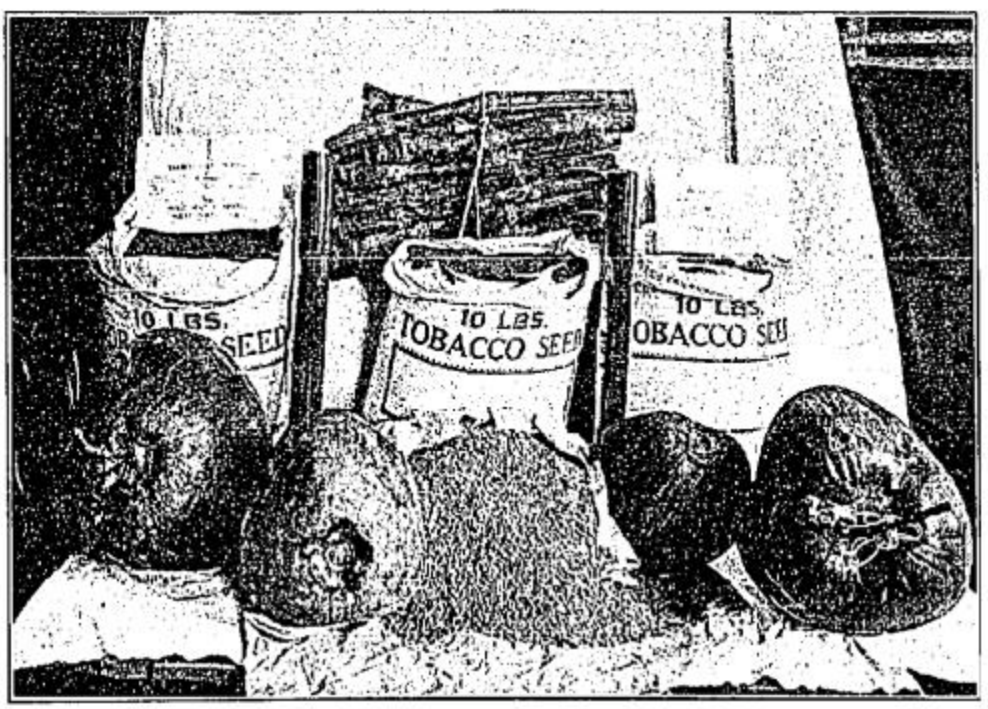
Work performed.—During the year, 634 vessels from foreign countries arrived at the ports of Manila, Cebu, Iloilo, and Zamboanga. These vessels were boarded and carefully inspected for any incoming plant materials. Of this total number of vessels, 471 stopped in Manila, 96 at Zamboanga; 33 at Cebu, and 34 at Iloilo. The port of Manila is the busiest of all the stations as the greatest amount of plant materials were received here, while Zamboanga ranks as second. On these vessels, 679,440 horticultural parcels arrived, and the same were inspected in the four quarantine stations. The distribution of these importations as inspected by the different quarantine stations were: Manila, 545,528 parcels; Zamboanga, 129,338 parcels; Cebu 3,211 parcels, and Iloilo, 1,363 parcels. The great bulk of these plant materials consisted of fruit and vegetables for provincial and local consumption in the different ports of entry. The parcels received and inspected in the post offices consisted mostly of seeds, cuttings, and bud sticks. These were carefully examined in the Plant Pathology Laboratory specially whenever symptoms of diseases were found. In cases of the presence of pests, the material was referred to the entomologist. There were also a number of these stocks which had to be planted under observation in the isolation grounds at Harrison Park, to determine the presence of diseases and pests, and the same were released or destroyed depending upon the result of the test. Besides the above mentioned classes of plant material, different kinds of ornamental plants, consisting of chrysanthemums, dahlias, Chinese water lilies, dwarfed citrus and many other flowering plants from China and Japan were frequently received with soil. Disinfection of the soil was always performed. At present, there are 416 parcels which include rice and sugar cane awaiting final action. Some of these are planted in Harrison Park, while the others are in the hands of the consignees for isolation.

Disposal of materials and fumigation.—A great quantity of plant materials were fumigated this year. Of the total 679,440 parcels inspected, 659,268 parcels were certified as free, 6,900 parcels were fumigated and partly disinfected, because of injurious insects, while 9,113 parcels were partly destroyed by fire on account of the presence of citrus scab (*Cladosparium citri*) black spots, (*Phoma citricarpa*), and other diseases that have never been reported in this country, as well as those that are known here but not as yet widely prevalent. Some of



(*a*) Intercepted contraband plant materials

(Tobacco seeds from Brazil. Sugar cane from Hawaii. Apple fruits from Hawaii. Rice seeds from Louisiana, U. S. A., and China)



(*b*) Intercepted contraband plant materials

(Sugar cane cuttings from Hawaii. Tobacco seeds from South Boston, U. S. A. Coconuts from Hawaii and Singapore. Rice seeds from United States)

the most important interceptions, however, were the 2,446 parcels returned to shippers, and 1,713 parcels which were seized and destroyed by fire as they were among prohibited materials governed by special quarantine orders. In the course of inspection, importation of these important crops, like rice (*Oryza sativa*) sugar cane (*Saccharum officinarum*), coconut (*Cocos nucifera*), tobacco seeds (*Nicotiana tabaccum*) from foreign countries and prohibited fruits such as apples and grapes from Hawaii and Spain were frequently seized by the plant quarantine inspectors. These frequent seizures of contraband materials show the importance of this work, without which important diseases and pests would be imported into the country and would no doubt add to the many enemies of crops which are already found in the Philippines.

Seizure of diseased materials of oranges from China and Japan was done at times, because it was the only way to minimize the possibility of introducing diseases of these fruits. The principal diseases found on these fruits were citrus scab, canker, phoma spots, and melanose. These diseases are destructive to the citrus industry, as have been the experience of other countries. While the Philippines is still free from these maladies, with the exception of the canker, it is a wise policy to have rigorous restriction against the introduction of these fruits. To this end, a recommendation to prohibit the entry of all the fruits attacked by these diseases was submitted. This is the only method to safely protect the country from the introduction of these diseases. The present practice of seizing diseased materials is not very effective as spores of fungi and other organisms cannot be seen on fruits that may appear sound.

Inspection of out-going materials.—The inspection of outgoing materials intended for exportation to other countries was also performed in the different stations. During the year, 2,478 horticultural parcels mostly consisting of seeds, cuttings, root stock, and ornamental plants, were inspected. Of this number, 1,317 parcels were certified in Manila and the rest in Cebu and Zamboanga. More than half of these were fumigated before certification, while only 399 parcels were certified without treatment.

Diseases and pests intercepted.—During the year many plant diseases and pests were intercepted in the port of Manila. Many of these, have been known in the Philippines. Among the most important of the diseases are the citrus scab (*Cladosparium citri*) black spot of oranges (*Phoma citricarpa*), melanose also

causing stem rot (*Phomopsis-citri*), (*Alternaria phaseoli*) on bean seeds, black rot (*Sphaeronema fimbriatum*) on sweet potatoes and many others.

Among the pests that were intercepted during the year were a weevil (*Bruchus lentis*) on lentils from Spain, black parlatoria (*Parlatoria sp.*) on oranges from China, the sweet potatoes weevil (*Cylas formicarius*) scale insect (*Chionaspis sp.*) on pears from China, Florida red scale (*Chrysomphalus sonidium*) on Chinese oranges from China. Many of these diseases and pests have been often intercepted by the plant inspectors.

The foregoing will show very clearly that foreign inspection and certification of plant material cannot be well relied upon. During the enforcement of the Plant Quarantine Act, the reinspection has given the Plant Quarantine Board here a fairly just appreciation of the continuing risk with the entry of such inspected and certified plants in the countries of origin. Again, these lists show that great numbers of these diseases were being brought here every year, and under the present system, the introduction of known diseases was reduced to a minimum.

Many of these intercepted diseases are not now known to be established anywhere in these Islands, and numbers of them, if established, would become important farm, garden or forest diseases. However, under the present system, inspection is very often a safeguard of little importance since many of the diseases are not discoverable by mere inspection or may develop to a visible stage after a period of months or even years after the plants have been ipmorted.

LOCUST INFESTATION

The serious infestation at the beginning of the year has been economically controlled by means of practical scientific methods. The readoption of ordinary soap solution spray after a thorough study of the habit of the locusts has been very successful. In the past, chemical method of control was tried but it was regarded ineffective. This work was resumed since 1922. After several trials of the use of arsenical compounds of different form and after a thorough scientific study of the habit of the locust in the field, it has been proved that chemical control is practical and economical.

Several insecticides were tested such as kerosene and crude oil emulsions, red pepper solution, sodium arsenic solution (formed by combining white arsenic and sodium hydroxide) resin-caustic soda solution and ordinary Chinese yellow laundry soft soap. The two last solutions were found to be deadly to

Barrels of grapes from Spain, a Country infested with Medeterreanean fruit fly (*Ceratitis capitata*)

locusts. The soft soap solution being the simplest and easiest to prepare has been adopted discarding practically the resin-caustic soda which was used largely during the first half of the year. A circular on soap as a locusticide was prepared by our entomologist and distributed to the municipal and provincial authorities and to locust inspectors. Besides liquid sprays, various arsenicals applied as dust, as lead arsenic, white arsenic, and calcium arsenate were also tested. Calcium arsenate, being the cheapest and about as effective as the other arsenical compounds, was adopted. Guns and bellow dusters were purchased and distributed to locust inspectors. Calcium arsenate is now being used as a dust on locusts extensively. The most extensive application was made at San Jose, Mindoro, by the coöperation of the Aviation Corps, U. S. Army. The infested fields were dusted from an airplane.

The readoption of the application of insecticides in the dust form by the other countries with newly invented dusting machines has been taken advantage of and resulted in more economical methods even when the infestations were far from populated areas and in places where water is not available for laborious spraying.

Early in the year, 22 provinces and 70 towns were infested. By July, 36 provinces and 270 towns had been visited. When the spraying and dusting method were adopted, the infestation was reduced gradually to 12 provinces and 51 towns.

In many cases, the hoppers do not live over 15 days due to spraying and dusting in the place where they hatched. While in the past, they were not only able to live much longer but many swarms of hoppers become fliers.

Due to limited funds, the Bureau was not able to send expedition parties to unpopulated cogon areas where the locusts usually develop into fliers and infest the populated area.

The difficutly of carrying out the provisions of the Locust Act in the unpopulated grass lands of this country is the direct failure to exterminate the locust completely.

At least a considerable percentage of the original swarms of locusts that infest the cultivated areas have their origin or at least develop into larger swarms in the interior of Isabela, Nueva Vizcaya, Mindoro, Camarines, Masbate, Leyte, Bukidnon, Cotabato, and other sparsely settled provinces, scores of miles away from inhabited places. We frequently learn of the existence of isolated swarms from Constabulary patrols, hunters, lumber men, *et al.* In the interior, great distances away from the populated areas, it is usually some months—from about

March to May—before they reach the cultivated areas and suddenly become a serious menace, the farmers begin to realize their inability to cope with the situation.

While the present law provides for compulsory service under all conditions, sufficient people could not be assembled in many such places, and it would be very unfair to keep the few people there working to exterminate the pest when their families are likely to starve, if they are not provided for. The fact is that, under the present system, the locust fighters waste about 50% of the time travelling back and forth between their homes and the uninhabited regions.

Neither should the remedy be expected from the bigger planter, and farmer who pays the required redemption fees who may be located scores of miles away and staggering on his feet on account of low prices, rinderpest, flood, debt, etc.

No lasting success can be obtained unless the pest is destroyed at all known sources as soon as discovered, and this cannot be done with the means available. While the breeding places vary from year to year, it is known that there are practically no locusts during the month of January, February, and March and that the infestation generally begins in a few provinces at a time in April reaching its maximum during July of each year.

To carry on the campaign effectively in the unpopulated regions, it would be necessary to hire body of men, organize them into scouting parties to locate and exterminate them right in their breeding areas. Funds for this work are required by this Office for salary and travelling expenses of the men and for purchasing equipment and materials.

EXPERIMENTS WITH THE USE OF ASPHYXIATING GASES FOR KILLING GRASSHOPPERS WITH THE COÖPERATION OF THE U. S. ARMY

Several trips during the year were made by Captain Walton into the field for the purpose of experimenting with various kinds of gases available.

During the year, the one ton of chlorine and 200 pounds of chlorpicrin requested by this Office from the Federal Government arrived. They were used in the field so as to compare the results with those obtained in laboratory experiments carried on during the year before.

Judging from the reports received from Captain Walton that while the gases are fatal to the locusts yet the application in general way cannot be considered practical due to the cost and danger of the application to other animal and plant life. The ingredients experimented with, so far are the following: Chlorine, chlorpicrin, arsenical fumes, carbon bisulphide, and diphe-

nylammechalo rarsine. Captain Walton was relieved by Lieutenant Jennings, a recent arrival from the United States, who is expected to continue the investigational work along this line.

COÖPERATION OF THE AIR SERVICE, U. S. ARMY

The success obtained by the use of airplane in dusting against the cotton-boll weevil in the United States suggested the idea of using them to dust locusts in the isolated regions. Arrangements were made to have the Army Air Service coöperate. Mr. Fabian O. Bugarin, who is a graduate air pilot, was detailed to Camp Nichols to coöperate with Lieutenant Weddington in the preparation of a hopper. As the Army planes are entirely too powerful and fast for dusting purposes, the Air Service borrowed from Judge Ingersoll, the local representative for the Curtis Airplane Co., one of the J N 4-D planes, fixed it and fitted with a hopper. Experiments in dusting were made by the use of common lime. This plane was afterward shipped to Mindoro. Mr. Bugarin also was sent to San Jose with highly successful results.

Lieutenant Harry Weddington, U. S. Army Air Service has now invented a hopper dosser which prevents the wasting and clogging of the dust placed in it. He is a real enthusiast in this mode of fighting locusts. Previous to this, he had a wide experience in the United States in the killing of boll-weevils attacking the cotton in the Southern States, hence the idea of the perfecting of the hopper originated. This Bureau greatly appreciates what he has done.

A complete report of his work in the extermination of locusts done by the Air Service in coöperation with the Bureau of Agriculture and the Philippine Trust Company is now in the hands of His Excellency, the Governor General. The success obtained in the use of airplane in dusting locusts leads us to recommend the adoption of this modern process of fighting this pest especially in their breeding places in isolated and unpopulated areas.

PLANT DISEASE SECTION

For the first half of the year 1923, the work of the Plant Diseases Laboratory was confined to investigation or reported field diseases and giving control measures, besides occasional inspection of the experimental stations, and determination of intercepted plant diseases of the plant quarantine stations.

At the assignment of Dr. N. G. Teodoro as incharge of the laboratory about the middle of the year, the Plant Diseases Laboratory has been made a distinct section of this division.

Under Dr. Teodoro's direction, the Plant Diseases Laboratory is rendering excellent work and is now fast accomplishing results of the work outline for the personnel for which the purpose in the creation of this section was intended, namely the study and the control of our most valuable economic plants principally and for other phytopathological work it may be called upon to do.

The technical assistants were ordered to resume their corresponding studies of the respective plant diseases namely of the sugar cane, abaca and bananas and of the rice.

Banana diseases.—In 1920, the banana disease known in other countries as banana wilt (*Fusarium musae*) was reported for the first time in the Philippines. It attacks the Latundan variety (*Musa sapientum*) which is the most popular variety in Central Luzon. The control of banana wilt is found to be possible by planting resistant varieties such as the Saba variety or the Chinese banana, *Musa cavendishii*.

On October 9, 1923, a man was sent to Calauang, Laguna, in order to investigate the occurrence of a plant disease in the banana plantations as reported by the president of the town.

In this investigation, there was observed the presence of banana wilt, the same disease which was first noted and reported in 1920 in the municipalities of Los Baños and Calamba, Laguna, and in three municipalities of Batangas Province.

Observations showed that once a plant is attacked, the entire stool is sure to die sooner or later. Generally, the plant succumbs to its ravages just prior to the blooming period, so that it is not unusual to see drying plants with their bunches half formed. It is interesting to note that the disease is confined only to one variety, the Latundan or Tordan. Other varieties like the Lacatan, Bongulan, Ternate, Morado, Saba etc. have not so far been observed to suffer from this malady even if they are growing in the midst of a veritable hotbed of infection. This condition offers a means of controlling the disease.

Abaca heart rot.—In April of 1920, Messrs. Serrano and Lee started their investigation of an abaca disease, known as abaca heart rot. Reinking attributed the disease to be due to bacterial organisms.

Isolation and inoculation experiments were done by Mr. Serrano in order to confirm the earlier work of Reinking, and the results published in the Phytopathology (Vol. 13, No. 5, pp. 253–256, 1923).

Bacteria were found to be commonly associated with advanced stages of the disease, but an imperfect fungus belonging to the

genus Fusarium was found uniformly associated with the disease. An examination of fresh frozen sections and of serial paraffin sections showed the presence of fungus hyphae in the early advancing stage of the disease.

Repeated isolations were made and out of 1,468 plantings about 60.44 per cent gave a pure culture of Fusarium. Few fungi of other genera appeared in such plantings. The bacteria isolated in the older stages did not appear uniformly.

Attemps were made to identify this Fusarium species. *Fusarium cubense*, E. F. Smith, is the cause of banana wilt. This banana fungus and the abaca plant fungus were both cultured at the same time. Comparative morphological and cultural studies were found to be impossible in distinguishing these two fungi.

Such being the case, inoculation studies were made whereby the banana wilt fungus was inoculated into banana plants. This produced the characteristic symptoms of the disease on bananas, such as the blackening of rhizomes, splitting of the pseudostem and yellowing and drying of the leaves. The same organism inoculated with the same technique into the pseudostems of Manila hemp plants did not cause such symptoms and the abaca plant was at the time considered resistant.

Inoculations were made with needle punctures, through the thick pseudostems, into the central cylinder of abaca plants with the banana wilt Fusarium and with the abaca plant Fusarium. The banana wilt Fusarium gave 65 infections in 115 inoculations, or 36.5 per cent; the abaca Fusarium gave 89 out of 134 attempts or 66.4 per cent.

Since the morphological and physiological characters of the hemp plant pathogene seem to be similar to those of the banana wilt organism, *Fusarium cubense*, the two must be considered for the present, at least as belonging to the same species.

The conclusions moreover are that *Fusarium cubense* cannot produce banana wilt symptoms upon the Manila hemp plant, but if inoculated into the growing central cylinder of the abaca plant by means of the proper technique, it can produce typical heart rot. The interesting situation is developed of a fungus species producing one set of symptoms on one host plant, and an entirely different set of symptoms on another.

Only two banana plants have been inoculated with the abaca fusarium, but both plants have given banana wilt symptoms, probably more promptly and virulently than would *Fusarium cubense* direct from banana wilt. A control puncture remained healthy.

This problem has been more or less completely worked out excepting the practical method of control. Basing upon the nature of the disease and the behavior of the causal organism, the use of resistant varieties seems to be the practical method of control. In order to determine this, it becomes necessary to grow side by side on infected soils, all varieties of abaca that are commercially grown in the Philippines. This phase of the work is already under way.

Root rot or bunchy top.—The presence of this disease was discovered in April of 1920 in Silang, Cavite.

Isolation experiments have already been carried out and a number of different organism was found associated with the disease in one way or the other. A species of *Phytium* a species of *Sphaeronema* and four species of *Fusarium* were among those isolated. A nematode, a tiny eel-worm, which according to Dr. Cobb is the root-gall nema, *Heterodera radicicola* was also found. This nema is reported to cause root trouble to hundred of different kinds of plants including garden crops of great economic value in both the Eastern and Western Hemispheres. As the trouble seems to be located on the roots of infected plants it is believed that soil treatment, that is, application of commercial fertilizers, may prove an effective remedy for the disease.

According to available literature on this subject, investigators engaged in the study of this root-gall nema, as they called it, utterly failed in their attempt to find out effective means of combating the malady by the use of chemicals without endangering the health of the plants so treated. In infected districts, crop rotation for five years successively using immune plants, may eradicate the pest; but this can be done to advantage only with annual crops and not with permanent ones like the abaca. Our attention and efforts are directed to the steps we are taking in combating the heart-rot disease, that is, the planting bf resistant varieties.

Experiments conducted by Mr. Goco with fertilizers have shown that alkaline elements such as ashes, sodium nitrate, lime, etc., help the abaca plant to resist both diseases. Nevertheless, this cannot be taken as final inasmuch as the experiment so conducted was not extensive enough to warrant conclusive results. In view of this, further experimentation on this particular phase of the problem is deemed essential, hence the carrying out of more extensive tests which, in the near future, will be well under way.

Deterioration of the abaca.—Since 1921, considerable work has been done by Mr. Serrano on the deterioration of the abaca fiber (Manila hemp.) In April of that year, a hank of defective abaca fiber (Grade J) was received from Smith, Bell & Co. Ltd., with the information that it has been returned by importers of London, because of its inferior tensile strength. Isolation and inoculation tests have been carried out and positive results were already well under way when, unfortunately, because of some other work which demanded immediate and concentrated attention was not completed to the extent compatible to giving conclusive results. As a matter of fact, the work was so neglected, abandoning it until shortly after the middle part of this year, when Mr. Serrano started the experiments all over again. The objects of this work are twofold, namely, (1) to ascertain the true cause (or causes) of deterioration and (2) to develop, if possible, practical methods of control.

In these studies, he was able to isolate from samples of the defective abaca a number of bacterial diseases and different species of fungi. In the latter case he isolated two species of *Aspergillus niger* and *Aspergillus sp.* as well as the sterile fungus which cause deterioration of the same length of time. Sterile absorbent cotton and sterile filter paper of high grade were also inoculated with the same organism obtaining the same deteriorative effect hereafter. Histological preparations made out of the naturally infected fiber show the presence of fungal hyphae in partly or totally decayed tissues, a phenomenon which clearly defines the direct association of the fungi in question with the deterioration of the fibers.

Informations from different producers of abaca and dealers, are to the effect that defective fibers are found only among fibers of low grades like "J," "L," "M," etc. (fibers which are partially cleaned and naturally contain much pulp) and never on the "Good" and "Excellent" grades. It was also reported that defective fibers were found only in bales stored say for five months, a year or more. This was corroborated by Serrano's investigations within and outside the laboratory. With this information, it can conclusively be stated that the causes of the defective abaca fiber are due to certain microorganisms, namely, *Aspergillus niger, Aspergillus sp.* and a sterile fungus. The damage encountered due to this disease can be minimized (1) by proper drying of the fibers before they are deposited in the warehouse (2) by proper ventilation in the warehouse, (3) by avoiding too long keeping of the fibers in the warehouse par-

ticularly of the low grades, and in addition (4) by stopping the production of low grades.

Diseases of rice.—Specimens of diseased rice were received from assistant agricultural extension agent of the Bureau stationed at Tarlac Province. These specimens were identified to be due to *Sclerotium oryzae* Catt.

Stem rot of rice caused by this organism is the worst disease that has yet been recorded on rice in the Philippines. Rice plants attacked by this disease succumb to it, and new plants shoot up. But these new plants, or late tillers, yield very little or no grain. In other words, it causes a partial sterility of the panicles and for this reason, it has wrought great damage. Its distribution in the Philippines is not definitely known but losses occasioned by this disease have been fairly estimated at from 30 to 80 per cent.

In the early part of the year (1923) isolation of the causal fungus were successfully made by Mr. G. M. Reyes from diseased stems, and from sclerotia from leaf sheath, stem, and root stock. Cultures were made from specimens obtained from Arayat, Santa Ana, and Zapote, and the same fungus was produced. The organism grows well on glucose agar, rice agar, potato cylinder, potato agar, and sterilized rice tissues, but it grows more abundantly on corn meal and on steamed rice. In culture, the growth agrees very decidedly with the descriptions published by Risdale and Shaw on boiled rice and one glucose agar, respectively.

Observations under natural conditions seemed to show that breeding of resistant varieties would greatly keep down this disease, but it would be well to observe also precautionary measures, at least in this country; such procedures as burning infected stubble, selection of seeds from disease-free fields, elimination of diseased plants in seed beds, early plowing of the field, by not allowing irrigation water to run from one infected to an uninfected field, etc. In Pampanga, for instance, a variety of rice, Macan San Miguel, was observed to be quite resistant to this disease.

It was also observed that rice plants growing in some fertile spots were not seriously affected with this disease in the Philippines. The possibility is suggested of experimenting with the use of fertlizers as a remedy. This will also be investigated in connection with the same disease.

Sugar-cane disease.—In September 1923, Mr. Medalla was sent to Batangas concerning sugar-cane disease in the province.

In Tuy and in part of Balayan he noticed on the leaves of the sugar cane the reddening and drying. He noted that this abnormality on the sugar-cane leaves was due to a leaf fungus. In this town, the disease was not serious at all attacking only the very old leaves, and is prevalent among thicker and more vigorous canes, but practically absent on thinly growing canes in the same field.

In Lipa exceedingly dry leaves were noticed. In the barrios of Maraou, Inisluban, Antipolo, Pinagkauitan, Sabang, and Mataas na Lupa the disease was serious. On a sugar-cane shoot all the leaves are attacked even the first folded leaf. The three or four lower leaves were so badly attacked that they were entirely dry and thus could not function any more. In Malvar the canes were noticed to be in the same condition as those in Lipa.

The same disease was noticed in San Jose, Tanauan, and Santo Tomas of the Province of Batangas, also in Calamba, Cabuyao, and Biñang in Laguna Province but it was very slight in these towns.

Isolation experiments for the determination of the causal organism is being made and the cause of the disease will be reported later.

Another sugar-cane leaf spot noticed in Lipa and in Malvar by him was the mosaic disease. But such sugar-cane leaf disease is very rare in those towns not like in most of the towns in Occidental Negros.

Another enemy of the sugar cane in Lipa which he notice in his sugar-cane disease survey work was a plant parasite of sugar cane. The plant parasite is scientifically called *Asginetia indica* L. It grows from a seed. This plant parasite is found on the base of the sugar cane parasitizing the sugar-cane roots. He noticed this sugar-cane root parasites in Santo Toribio, Lipa. Such root parasite is also present in Laguna Province. It damages the canes, its host, by greatly reducing the sugar content in them.

The disease that causes the reddening and drying of the sugar cane in Lipa, Malvar, Tuy, Balayan, San Jose, Tanauan, and Santo Tomas can naturally be controlled. It is certainly sporadic. It is a leaf spot that rapidly multiplies in the long continuous rainy days, but it is controlled when there is not much rain and when the sun shines. A series of inoculation experiments is to be carried to find out which varieties are resistant to this leaf-

spot fungus and in that way the disease can entirely be controlled by introducing such varieties.

Field experiments on smut disease of sugar cane were conducted by Messrs. Lee, Reyes, and Clara at Manila on a small scale and duplicated at Canlubang Sugar Estate on a plantation scale.

The objects of the experiment were: (1) to determine the extent of transmission of the disease by points and cuttings; (2) to indicate the loss due to smut to the planters; and (3) to determine the extent of other means of transmission of the disease.

The experiments at Manila consisted of four plots planted as follows:

Plot 1 consisted of two rows, each planted with 12 cuttings from healthy canes.

Plot 2 consisted of two rows, each planted with 12 cuttings from diseased cane.

Plot 3 consisted of two rows, in each row 6 cuttings from healthy cane being alternated with 6 cuttings from diseased cane.

Plot 4 consisted of four rows planted with cuttings from healthy cane soaked in the same water and same receptacle with cuttings from diseased cane.

The experiments at Canlubang consisted of four plots planted as follows:

Two plots planted entirely with cane points from stools affected with smut.

Two plots, lying adjacent to the first two, planted entirely with cane points from healthy stools.

The Uba variety being extremely susceptible to smut disease was used in these experiments.

From the results of these experiments the authors drew the following conclusions: (1) that germination of cane points from stools affected with smut is decidedly poorer than that of points from healthy cane; (2) points or cuttings from stools affected with smut reproduce the disease in a high proportion of cases; (3) there is no cane yield from planting points or cuttings from stools affected with smut; (4) points from healthy cane allowed to soak in the same receptacle with cane from smutted stools showed 8.33 per cent of the resulting cane plants to be affected. This is apparently one method of the spread of the disease; (5) in the six months duration of the plant crop the spread of the disease into the healthy stools was very slight, only 0.75 per cent of the stools from healthy points showing the disease; (6) the increase of the disease after ratooning amounted to 68.97 per cent of the original healthy stools; (7) this gives us an

hint that in susceptible varieties, infection of healthy stools may take place through the cut surfaces of the stubble; (8) the spread of the disease into the originally healthy stools in the first ratoon crops, amounted to 98.44 per cent or an almost total loss of the ratoon crop.

Mosaic disease.—Field experiments on mosaic disease were continued in 1923.

The objects of the experiments were to determine, (1) the extent of the transmission of mosaic disease by points and cuttings; (2) the extent of losses on the native varieties due to this disease; and (3) the methods of transmission of the disease other than by cane points and cuttings.

Two plots each consisted of 8 rows, each row being planted with cuttings obtained from healthy stools alternating with cuttings obtained from stools affected with mosaic disease. One plot was planted with Luzon White variety and the other plot (the duplication of the first) was planted with Cebu Purple variety.

The results showed: (1) that there is very small transmission of the disease from diseased to healthy stools, indicating that mosaic disease is perpetuated almost entirely by carelessness in selecting the seed and that insect and other possible methods of serial transmission are such minor factors in the disease transmission; however, repeated experiments are necessary to warrant the apparent conclusions from these experiments; (2) that germination of cane points from stools affected with mosaic disease is usually slightly poorer than those from healthy cane; and (3) that the disease may be produced at will on any soil, irrespective of draught, by planting from affected stools.

Another two plots, intended to demonstrate more graphically to the planters the losses from the disease, each consisted of 12 rows, were planted as follows:

(1) Six rows were planted entirely with cuttings from stools affected with mosaic.

(2) Six rows were planted entirely with cuttings from healthy cane.

One of these plots was planted with Luzon White and the other (the duplication of the first) was planted with Cebu Purple variety.

The results showed (1) that cane points and cuttings from diseased stools will reproduce the disease in a large percentage of the resulting plants usually 100 per cent, which corroborate the results reported from Java, Hawaii, and Porto Rico; and (2) that mosaic diseased stools, even if affected when young,

usually make some growth, and affected stools are consequently not a total loss.

Since no data of weighing were secured from the different plants in order to obtain definite data as to the amounts of losses, this phase of the work will be taken up in connection with the present experiments at Harrison Park.

Red vascular bundle disease of the sugar cane.—Over two years ago this disease was observed on Hawaiian canes grown at Alabang Experiment Station. But because it was not destructive then, no attempt was made to investigate the trouble until last year when it was found affecting other varieties including the native canes as the Negros Purple, Cebu Purple, Pampanga Red, Luzon White, etc. Isolation experiments were made obtaining a yellow bacterial species uniformly in the majority of canes, believing that this particular disease is the true gum disease caused by *Bacterium vascularum* described by Cobb, Smith, and others. The results, however, have always been negative.

When Mr. Medalla returned to Manila last July from Negros where he was detailed by Mr. Lee to work on miscellaneous sugar work, he isolated the organism causing the diseases enumerated below. Pure cultures of these organisms are now kept in the laboratory for future use:

1. Root rot of sugar cane caused by *colletetrichum falcatum.*
2. Red vascular bundle disease of sugar cane caused by *Bacterium vascularum.*
3. Ring spot on sugar cane leaf caused by *Laptospaheria sacchari.*
4. Sclerotial disease caused by *Sclerotium rolfsii.*
5. Pineapple disease caused by *Thielaviopsis paradoxa.*
6. Lipa leaf spot disease (the organism unknown yet).
7. Helminthosporium spot caused by *Helminthosporium sacchari.*

Attempts have also been made to isolate the organism causing the Lipa leaf-spot disease, but the organism isolated has not been proven as yet by inoculation to be the real cause of the disease.

About the middle of July, Mr. Medalla inoculated some Young Lahaina canes with the pure culture of *Bacterium vascularum.* The plants were planted in pots and were about two months and a half old when they were inoculated. The methods used for inoculation were (1) by needle punctures through the leaves, (2) by needle punctures through the main stalks at the base of the plant; (3) by digging a small canal around the base of the plants and pure culture of the organism poured into the canal. The idea is to give the roots of the plants a chance to take up the organism and to see if infection can take place from the roots.

Observations were made at various times after inoculations, to know which of the methods would be effective. None of these methods, however, showed positive results. The inoculations were to be repeated but on account of the lack of plant materials, the work was put off.

Last August inoculation experiments on Lahaina and H–109 varieties with the ring-spot disease were done at Harrison Park. The method employed was by needle punctures through the leaf of the sugar cane. Both the old and the young leaves were inoculated. Ten plants were used in each case. From the subsequent observations made it was found that both the young and the old inoculated leaves took infection. The uninoculated leaves remained healthy at the end of the experiment. However, repeated experimentation along this line will be made in the future in order to confirm the former results.

There are two stages of the disease, namely, the conidial stage and the perithecial stage. Attempts to isolate the perithecial form of the organism failed so far. Further attempt will be made on this work on the near future. The object of isolating this form of the spore was to use it for inoculation because there is an undecided fact in this particular line of science that the perithecial form of this fungus does not infest the plant. Repeated experiments along this line will be made in the future.

Experiments to determine the effect of nitrogen upon mosaic disease are being conducted at Harrison Park this year.

Experiments on disease resistant varieties are also being conducted at Harrison Park. Another portion of the same, that is, field adjacent to the plots used for fertilizer experiment 29 sugar-cane varieties and hybrids were planted in the months of October and November. The seeds were obtained from the parent sugar-cane field planted two years ago in Harrison Park and also from the plots at the Bureau of Science. Twenty-six of these varieties are foreign while the rest are native.

Experimental plots.—For the purpose of conducting field experiments on various plant diseases, it became necessary to acquire more land in addition to the plots used by the Plant Disease Section at the Singalong Experiment Station. So the Bureau obtained from the officials of the City of Manila permission to use a tract of land at Harrison Park, measuring 40 by 100 meters. This tract of land is located directly west of La Salle College on the side of the canal where the banana plants are growing. This was immediately prepared and planted with rice and sugar cane for inoculation work.

On December 5, 1923, authority to use additional tract of land was again obtained from the Mayor of Manila. This last tract of land is located directly south of the sugar cane parent field. The total area acquired by the Bureau from the City is about 3 hectares.

Coconut pests and diseases.—The work for the eradication of coconut budrot and the sanitation of coconut groves to prevent the beetles has been carried on right along as demanded by the owner of plantations. The work was conducted by Plant Quarantine Inspector Villanueva and his assistant.

A communication from the Governor of Jolo through the Bureau of Non-Christian Tribes was received requesting that a campaign be started against the bettles which were killing many coconut trees. Mr. Villanueva, assistant plant inspector of Zamboanga was ordered to proceed and start the beetle campaign. The result of the campaign is shown below:

TABLE LXXXV

Total number of trees inspected	48,887
Bearing	22,659
Non-bearing	26,228
Luba trees	62
Trees infected with budrot	22
Trees attacked by B. beetles	3,299
Trees attacked by red beetles	815
Other pests	1,805

The trees infected with budrot and those badly infected with pests were all destroyed. Sanitation of the plantations was vigorously enforced.

RECOMMENDATIONS

1. For the sake of efficiency, it is earnestly recommended that the salaries of deserving personnel of the Plant Pests Control Division be increased.

2. In dealing with the rice pests, as well as those of other staple crops, as sugar cane, tobacco, this division is of the opinion that the only way in which we can obtain complete and accurate data regarding the life history and habits of these pests and the methods of controlling them is to follow the example of other countries. For this reason, it is recommended that a sufficient amount of funds be appropriated for the creation of an entomological or rice pest station in one of the rice producing provinces preferably in Nueva Ecija, or Pangasinan for the purpose of studying such pests and trying out methods by

which the pests may be effectively and economically controlled under local conditions. The result of the work obtained in such a station will give a basis for an extensive control work program in all the important rice producing regions of the Philippines.

3. The Entomological Section is in urgent need of a building where the workers can do their laboratory work to better advantage, perform such routine work as their positions require, and keep the collection and entomological equipment of the Bureau in a safe and orderly manner.

Now and then scientists from other lands come to our country. A space is needed to accomodate such men in case they desire to do some investigation work, the results of which will be of value not only to them but also to us in the Philippines.

This section is also in need of additional personnel, preferably graduates of the College of Agriculture, especially those who have taken up advanced work in entomology. We need such for specific entomological problems that call for immediate attention, such as the study and control of pests that infest our staple crops such as rice, sugar cane, tobacco, abaca, coconut, etc. and those of our fruits, such as mango, citrus, etc. Very often the division is called upon to give remedies for such injurious pests and there is no sufficient personnel to study their biology thoroughly and accurately.

4. A building containing an inspection room for our nursery stock, a laboratory for research work and additional fumigation room and two separate buildings for a quarantine cage and fumigation are very urgently needed. An incinerator for burning condemned plant materials should also be provided right in the quarantine station ground at Manila. The present practice of burning these materials in the city crematory is very poor and unsafe as it involves much labor and time, and there is besides the risk of the people handling these infested fruits, thus spreading the disease or pests.

All plant materials or nursery stocks introduced into the country for the purpose of propagation should be tested for the presence of the disease and pests on our plant quarantine grounds. For this purpose, the construction of a quarantine cage in the isolation station is very necessary. For the present a part of Harrison Park is being used as the isolation grounds, because the lot at the Port Area is only suitable for the buildings of the Plant Quaratine Service.

The ports of Zamboanga, Iloilo, and Cebu should be provided with a building similar to the present inspection house at the

port area with better fumigation boxes and other necessary apparatuses.

5. It is recommended that Abaca Diseases substations be established at Silang, Cavite, and at Paete, Laguna, for carrying on the experiments on disease-resistant varieties of abaca and that the appropriation needed for this work be set aside.

6. A careful and thorough plant disease and pest survey in various parts of the Islands is very necessary. It should be continued from year to year. This requires the appointment of men trained in plant pathology and entomology. These surveys will give pathological and entomological workers a complete grasp of the distribution of the diseases and pests. It will be of value to research pathologists and entomologists in deciding where their work lies in determining the extent and character of their problems and in checking the results of their campaings. It will acquaint them with pest and with disease conditions throughout the country. Moreover, this must be made in order that intelligent quarantine section may be taken. The recommendation on the appointment of more personnel trained along these lines of science is reiterated.

DIVISION OF PUBLICATIONS

During the year ending December 31, 1923, there was issued a considerable number of publications, which excelled those of previous years. The policy followed that year was to give preference to the publication of practical instructions as embodied in the Bureau's circulars, into Spanish and local dialects, so as to popularize better farm methods. This gave encouraging results as shown in the exceptionally large number of circulars in Spanish and local dialects distributed in 1923.

The total number of publications issued during the year was 31 as against 18 in 1922. These publications were as follows: One annual report; 3 numbers of the Philippine Agricultural Review; 18 circulars; 9 miscellaneous publications. Six administrative orders were also published besides. The number of publications distributed was 30,159 as against 19,707 the previous year, an increase of 10,452.

The Philippine Agricultural Review.—Four numbers of the Review were ordered printed but at the close of the year only three were released, the last number still being printed. The total number of copies distributed was 3,180, as against 5,922 in 1922, or a decrease of 2,742. This decrease was due to the fact that the last issue, as just stated, was not yet released and that in 1922 issues for 1921 were published and distributed in

1922. The following classification shows the variety of topics contained in these issues:

	Articles
On Adlay	4
On Citrus	1
On Copra	1
On Fiber and Fiber plants	7
On Plant Breeding	2
On Plant Pests and Diseases	6
On Rice	1
On Sugar cane	1
On Tobacco and Cigar	3
On Veterinary	3
On Weeds	1

Bulletins.—No bulletin was issued in 1923. There is however being printed the Spanish translation of Bulletin No. 37 entitled "Rice in the Philippines," intended for the use of rice farmers who cannot read English. The number of old bulletins distributed was 1,168, as against 1,017 of the previous year or an increase of 151.

Circulars.—Eighteen circulars were published—9 in English, 14 in Spanish, and 4 in Tagalog, Visayan and Bicol—as against 9 in 1922 or 100 per cent increase. The most important of these is that on anthrax translated in Spanish and Tagalog. Twenty thousand copies thereof were printed and most of them were distributed among the farmers in the infested areas in Central Luzon. Copies in English and Spanish were also sent to all provincial governors enjoining them to translate them into local dialects and to distribute them among the farmers of their respective provinces.

The following shows the circulars published:

Circular No. 12.—Plant Pests and Remedies Therefor (Revised). English and Spanish.
Circular No. 16.—Pineapple Culture (Revised). English.
Circular No. 17.—Corn Culture (Revised). English and Spanish.
Circular No. 44.—The Pili Nut (Revised). Spanish.
Circular No. 46.—Instructions for Planting Upland Palay (Revised). Spanish and Tagalog.
Circular No. 47.—Instructions for Planting Lowland Palay (Revised). Spanish and Tagalog.
Circular No. 85.—Tobacco Pests and Diseases (Revised). English and Spanish.
Circular No. 91.—Coffee Culture. Spanish.
Circular No. 94.—Poultry Notes (Revised). Spanish.
Circular No. 104.—Raising Ducks. Spanish.
Circular No. 126.—Locust Extermination (Revised). English and Spanish.
Circular No. 130.—Notes on Cattle Raising in the Philippines. English and Spanish.

Circular No. 131.—Directions for Shield Budding (Revised). Spanish.
Circular No. 132.—Shade Trees for Streets and Roards. English and Spanish.
Circular No. 133.—Ilan Tanong at Sagot ukol sa "Budding." Tagalog.
Circular No. 134.—Kapok. Spanish.
Circular No. 135.—Suggestions for the Control of White Grubs. English, Spanish, Tagalog, Bicol, and Visayan.
Circular No. 136.—Anthrax. English, Spanish, and Tagalog.

There were distributed during the year 22,682 circulars, as against 10,481 the previous year on an increase of over 100 per cent. The following statement shows the distribution in details:

	Copies
Circulars in English	5,555
Circulars in Spanish	6,503
Circulars in dialects	10,624
Total	22,682

Miscellaneous publications.—Nine miscellaneous publications aggregating 59,500 printed copies—50,300 in English and 9,200 in Tagalog, were published.

Rural Credit Association Accounting. English.
Instructions for Organizing Rural Credit Association. English.
On Organization of Milk Coöperative Association. Tagalog.
On Organization of Poultry Association. Tagalog.
"Dapulak." Tagalog.
On Kerosene Solution. English.
On Resine Emulsion. English.
Abaca Heart-Rot. English.
Instructions for Locust Inspectors. English.

Administrative Orders.—The following Administrative orders were published during the year:

No. 23.—Regulations which shall govern the appointment of members of the Fiber Advisory Board and the methods under which said Board shall function.

No. 24.—Regulations governing the importation of certain classes of animals in accordance with the provisions of section 1770 of Act No. 2711 and Act No. 3052.

No. 25.—Regulations governing certain phases of the grading, baling, and inspection of Philippine fibers.

No. 26.—Preventing the spread of dangerous abaca diseases in the Philippine Islands.

No. 27.—Regulations governing the preparation, sale, traffic in, shipment, and importation of viruses, serums, toxins, or analogous products intended for use in the treament of domestic animals isued in accordance with the provisions of Act No. 3101.

No. 40.—Instruction for the use of anti-anthrax serum and spore vaccine in the control of anthrax.

Notes for the press.—A total of 664 pages of notes were furnished to the local press as against 628 in 1922.

LIBRARY

Books accessioned and publications received.—There were 53 books accessioned during the year. The approximate total of publications received in the library during the year amounted to 3,565.

Articles clipped and indexed.—There were 1,510 articles clipped and indexed from local papers.

Books for binding.—There are at present 188 books being bound at the Bureau of Printing.

Cuts handled and loaned.—There were 165 cuts handled and 33 loaned during the year, to other Government offices, local papers and commercial firms.

Borrowers and readers.—According to our records there were 265 borrowers and 375 readers during the year, who were mostly Bureau employees and students from different schools and colleges.

SUMMARY OF THE WORK IN THE LIBRARY

Books accessioned	53
Publication received	3,565
Articles clipped and indexed	1,510
Borrowers	265
Readers	375
Books for binding	188
Cuts handled	165
Cuts loaned	33

OTHER ACTIVITIES

Translation and correspondence.—During the year 1923, there were 1,279 pages of translation as against 628 pages in 1922. For the same period 651 letters were answered as against 632 in 1922.

Photographic work.—A total of 1,607 views were printed, 260 plates, 24 films packs and 12 rolls of film of 6 exposures each, developed during the year, as against 932 views printed, 103 plates and 7 rolls of film developed in 1922.

The cinematographic films, 6,000 feet long, were also exhibited at the provincial fair of Batangas and also at Ilagan, Isabela Province.

The multigraph machine did most of the printing of forms, letter-heads, envelopes, cards, and short circulars of the Bureau. There were 440,506 sheets on 57 work orders and 55,024 cards on 33 work orders, printed during the year, as against the combined total of 353,850 sheets and cards in 1922.

Mimeograph machine.—During the year there were printed in this machine 929,989 sheets on 920 work orders, as against 790,984 sheets in 1922.

Planotype machine.—Thirty-one thousand six hundred fifty (31,650) cards on 40 work orders were printed as against 38,932 cards the previous years.

RURAL CREDIT DIVISION

ACTIVITIES

Among the activities of this division during the year 1923, aside from making thorough supervision and careful examination of all the existing rural credit associations, the following may be included:

(*a*) Reorganization of some associations that had remained dormant during the year.
(*b*) Collection of overdue loans.
(*c*) Coöperation with the Agricultural Extension and Animal Husbandry Divisions in organizing coöperative marketing associations.
(*d*) Fighting Usury, which is becoming more rampant than ever.

PERSONNEL

In the beginning of this year, the following positions were filled:

1 Chief of the division.
1 Assistant chief of the division.
1 Supervising rural credit agent.
9 Rural credit agents.
1 Clerk.

The recapitulation made of all the returns received from association treasurers at the beginning of the year 1923 showed the following figures, which compared with those for the preceding year and in spite of the hard times, demonstrate slight increases:

TABLE LXXVI

	January 1	
	1923	1922
Number of associations organized	544	537
Number of associations dissolved		1
Total number of members	75,667	70,444
Total number of borrowers	26,620	23,648
Total number of depositors	3,426	3,418
ASSETS		
Circulating capital and cash on hand	₱2,523,313.52	₱2,393,646.63

LIABILITIES

Capital stock, shares sold to members	₱848,333.00	₱814,127.68
Deposits made by members and non-members	115,595.11	132,681.44
Loans obtained from the Rice and Corn Fund	1,012,125.16	1,030,435.91
Loans obtained from the National Bank and others	55,279.88	17,800.00
Surplus (entrance fees and interest earnings)	472,675.68	385,336.81
Reserve fund and other items	19,304.69	13,364.84
Total	2,523,313.52	2,393,545.63

As may be seen from the above figures, many depositors withdrew their deposits from the association to meet their most pressing needs, due to the prevalent financial stringency, but on the other hand many new ones either bought shares or began depositing their small savings in the association.

The most salient feature, however, which clearly denotes the success of the operation of the rural credit associations is the considerable increase in the income during the year, as well as the amount of ₱6,000 added to the reserve fund.

At the close of the year there were 547 associations in actual operation, six new ones having been organized and incorporated during the year, and three old ones dissolved. These are the following:

TABLE LXXVII.—*Incorporated during the year*

Zaragoza, Nueva Ecija	February 21, 1923	₱7,000.00
Tumauini, Isabela	April 5, 1923	10,000.00
Balasan, Iloilo	May 16, 1923	10,000.00
San Felipe Neri, Rizal	May 18, 1923	10,000.00
Gamu, Isabela	May 31, 1923	10,000.00
Polillo, Tayabas	December 27, 1923	5,000.00
Total capital		52,000.00

Dissolved during the year

Masinloc, Zambales	January, 1923.
Mauban, Tayabas	September, 1923.
San Fernando, Masbate	December, 1923.

The causes which prompted these associations to dissolve were that there were no persons in their respective community who seemed to be interested in community work.

Because of the difficulty of getting all the returns from the associations at the date of writing this report, it is impossible to show exact figures which will indicate the progess attained by these associations during 1923; but it may be stated that no signs of retrocession could be noted in any of them during the year though it is true that owing to the pressing demand of money many deposits were withdrawn, but such withdrawals will not affect the associations in general.

The reports from the municipal treasurers and inspecting agents of the rural credit associations which are on hand show that there has been a slight increase in nearly all associations. A good many of them declared dividends and in no case has the rate of dividend exceeded the maximum of 8 per cent per annum.

RECOMMENDATIONS

The following recommendations deserve careful consideration:

(*a*) That the Rural Credit Law be amended so as to remove from it all the provisions which make the associations less effective than what they should be;

(*b*) That Senator Soriano's bill whereby the privileges and exemptions enjoyed by the rural credit associations can be extended not only to agriculturists, but also to small industries, artisans, clerks, and persons of limited means, be enacted;

(*c*) That a purely Agricultural Bank which will be permitted to grant long-time loans for permanent improvements be created by special legislation; and

(*d*) That a member of the Rural Credit force be sent abroad to make a comparative study of the rural credit conditions and cooperative movement in other countries, such as India, Java, and the United States, in the same manner that this Bureau has sent to foreign countries persons to study various scientific processes in other agricultural lines.

VETERINARY DIVISION

PERSONNEL

On December 31, 1922, there were on the rolls 37 veterinarians (of whom 31 were Filipinos and 6 Americans), 3 American livestock inspectors 137 Filipino inspectors, 1 American clerk, and 1 Filipino clerk.

On December 31, 1923, the forces consisted of 45 veterinarians, 39 of whom were Filipinos, and 6 Americans, (this includes 1 American veterinarian on leave in the United States), 4 American livestock inspectors, 446 Filipino inspectors, 1 American clerk, and 1 Filipino clerk. This constitutes an increase of 8 Filipino veterinarians, 1 American, and 309 Filipino livestock inspectors.

ADMINISTRATION

Importation from foreign ports.—During the year, 4,819 cattle from Australia and 6,048 cattle and 1,662 carabaos from Pnom-Penh, French Indo-China, arrived at the port of Manila. At Iloilo, 25 cattle and 1,143 carabaos from Pnom-Penh were admitted in 1923. This shows a marked decrease in the importation of cattle and an increased number of carabaos. Compared

with the figures of last year, there was a total decrease of 11,020 head of cattle and a total increase of 1,559 head of carabaos.

The importation of cattle for slaughter under contract entered into previous to the enactment of Act No. 3052, was continued and more contracts pending recognition last year were finally accepted this year. As already stated in the previous year, Mr. Ramon Soriano was authorized by the Secretary of Agriculture and Natural Resources to import 13,000 head of cattle from Australia. Of this number, 10,139 head have been imported to date, which leaves a remainder of 2,861. He was further authorized by the Secretary on November 27, 1923, to import 8,000 head more, that added to the remainder makes a total of 10,861 head of cattle still to be imported. Mr. Faustino Lichauco was authorized by the Secretary to import 13,000 head of cattle from French Indo-China. Of this number 2,245 have been imported to date, leaving a remainder of 10,755 head still to be imported. Mr. Eugenio Evangelista was also authorized to import 8,200 head of Indo-Chinese cattle and of this number, 3,302 were imported to date leaving 4,898 to be imported. There remains, therefore, to be imported under contracts 26,514 head of cattle for slaughter.

Interisland shipments.—During the year, 18,649 head of cattle arrived in Manila from interisland ports as compared with 11,407 in 1922. There were 1,488 carabaos received as against 2,126 the preceding year.

Inspections for which fees were charged.—During the year, 161,566 animals of all kinds were inspected on arrival at Manila, for which fees amounting to ₱31,625.40 were collected. Of these animals, 124,810 were swine.

Postmortem inspections in Manila matadero.—In 1923 there were 134,635 animals of all kinds inspected at the Manila matadero of which number, 1,298 were condemned and 133,337 passed for food. The number slaughtered includes 114,961 swine.

Postmortem inspections in Pandacan matadero.—Five thousand five hundred forty-seven head (5,547) of cattle were slaughtered and inspected in 1923, at this matadero, of which 14 were condemned and 5,533 passed for food. Most of the animals slaughtered during the year at this station were imported from Pnom-Penh.

Postmortem inspections in Sisiman matadero.—During the year, 4,757 Australian cattle were slaughtered and inspected at this matadero, 263 of which were condemned and 4,494

passed for food. Owing to an outbreak of anthrax among cattle awaiting slaughter this station was closed from June 20 to November 9.

COMBATING OF ANIMAL DISEASES

Rinderpest.—During the year, 27,505 cases of and 23,220 deaths from rinderpest were recorded. This constitutes a substantial decrease from the 45,683 cases and 34,306 deaths reported in 1922. Rinderpest appeared in 32 provinces during the year but the only serious outbreaks occurred in Batangas, Bulacan, Masbate, Mindoro, Nueva Ecija, Sorsogon, and Tarlac. Other infected provinces were: Abra, Albay, Antique, Bataan, Bohol, Cagayan, Camarines Norte, Camarines Sur, Capiz, Cavite, Cebu, Iloilo, Isabela, Laguna, Manila, Mountain, Nueva Vizcaya, Occidental Negros, Oriental Negros, Pampanga, Pangasinan, Rizal, Samar, Tayabas, and Zamables.

At the beginning of the year there were 70 infected towns in 22 provinces and on December 31, 1923, 76 towns in 18 provinces. Counting each case where a municipality was taken up as infected or reinfected with rinderpest as a separate outbreak, there were 254 new outbreaks during the year.

The following table shows the number of rinderpest cases and deaths by 3-month period:

TABLE LXXXVIII.—*Rinderpest cases and deaths by quarters*

Year 1923	New cases	Deaths
First quarter	8,375	7,085
Second quarter	7,515	6,342
Third quarter	6,517	5,453
Fourth quarter	5,098	4,340
Totals	27,505	23,220

There was, during last year, a decrease of 18,178 cases and 11,086 as compared with the cases and deaths registered during the previous year. Although the infection is widely scattered, no new territory has been infected which has been free from rinderpest for a long time, with the exception of Lubang, a group of Islands belonging to the Province of Mindoro, where the deaths were high. With more adequate personnel to watch over the interisland shipment of animals, the losses from rinderpest could be further reduced by keeping islands freed from rinderpest clean. The present veterinary force should be increased gradually to the point of two veterinarians to a province paid out of the provincial funds, besides the regular force of the Bureau of Agriculture, which can be concentrated in those provinces

where there is serious outbreak of disease. This coupled with the popular instruction of the people relative to the prevention of animal diseases would bring the losses therefrom to the minimum.

Immunization.—Immunization of cattle and carabaos against rinderpest with virulent blood and serum was done only at Pandacan Quarantine Station and Iloilo Quarantine Station. The total number of immunized animals were 1,423 carabaos and 345 cattle. With the exception of several shipments (which were imported under special permit) the carabaos and cattle imported from rinderpest-infected countries come immunized to rinderpest as required by our regulations and are only tested on their arrival in the Islands. No funds were appropriated by the Legislature for the purpose of the Immunization Act.

Anti-rinderpest serum.—Very little serum was made this year, as there was not enough money available for the purchase of animals. It was considered cheaper to purchase the serum for the local manufacturers to supply the small demand for serum. The provinces wherein formerly large quantities of anti-rinderpest serum were used, were Negros Occidental and Iloilo. But this year, very little serum was used in these provinces because of the intensive vaccination carried on by the Bureau in these two provinces especially in Iloilo. The more vaccine is used in the field, the less serum demand there is. The serum is at present being availed of in those places where lack of proper facilities make it undesirable to use vaccine. The total amount of serum produced for the Bureau during the year was 340 liters.

Veterinary Research Laboratory.—The principal work undertaken during the year in this laboratory has been the improving and simplifying the technique in the production of anti-rinderpest vaccine. The efforts exerted along this line have been very satisfactory. The amount of vaccine that can now be obtained from one animal is three times as much as could be produced with the methods used formerly. Besides, it has been possible to increase the potency of the vaccine to a marked extent, and to do away with most of the complicated and expensive machinery used heretofore. As a result of this, the cost of production has been greatly reduced. Three injections are given one week apart.

During the year, 38,864 animals received vaccine treatment, 10,706 having received the three injections, 1,933 received the first injection only and 12,175 received the second injection. It is found in the field that oftentimes people do not bring their

animals for the successive injections after having received the first or second injection as can be seen from the figures given above.

Experiments have been carried on in keeping the rinderpest virus under artificial condition. There is one strain which is 112 days old up to date and which is still virulent. The virus at this age brought a susceptible animal down with rinderpest on the fourth day after injection. This same strain is to be tested from time to time to see how long it will retain its virulence.

Experiments have been carried on concerning the ability to throw the virus of rinderpest down by centrifugal force. It is found that the rinderpest virus can be thrown to the bottom of a centrifuge tube after three hours of centrifuging at 3,000 R. P. M. The top portion of the material being non infective to susceptible animals while the bottom part in the tube brought a susceptible animal down with rinderpest in the usual time, from three to four days. In these experiments 10 c. c. centrifuge tubes were used. The upper 7 c. c. of the contents being non-infective while the bottom 3 c. c. were virulent.

Some further work was done on the swine disease caused by a pseudomonas. It was found that cultures of this disease 4 years 8 months and 23 days old still retained their virulence for Guinea pigs. As per experiment August 27, two Guinea pigs were each given ½ c. c. suspension of pig pseudomonas culture 4 years 8 months and 23 days old.

August 29—the two Guinea pigs, injected with the pig pseudomonas, got sick on the 27th.

August 30—the two Guinea pigs, injected on the 27th, died on the night of the 29th

These two Guinea pigs were autopsied and presented good lesions. Pure culture of the pseudomonas were recovered from the lungs, liver, spleen, and heart blood of these Guinea pigs.

Some work has been started in developing vaccine against this disease.

This pseudomonas has been given to swine by feeding and by injection. When the disease is given by feeding it runs a rather chronic course. By injection it is very acute.

All the rabies diagnosis has been done at this laboratory for the City of Manila and near-by provinces.

This laboratory also did a greater part of the primary anthrax diagnosis when its presence in Sisiman Matadero was somewhat disputed.

Anthrax.—This assumed the nature of an epizoötic in the valley of Rio de Pampanga and in the low-lying

areas of Pampanga, Bulacan, and Bataan adjacent to the shores of Manila Bay. A lesser epizoötic also occurred on the shores of Laguna de Bay and along the Pasig River at Tagig, Pateros, and Pasig, Rizal. Meteorological and climatic conditions this year were evidently very favorable to the rapid development of the anthrax epizoötic. The areas above referred to were heavily inundated in the months of July and August. This was followed in September and October by hot dry weather which was so severe as to affect the rice crop.

About September 17 the veterinarian in charge of Pampanga Province heard rumors of carabaos dying in the municipality of San Luis. Upon investigation it was found that animals had previously died and that the fact had been reported to the provincial governor's office by the municipal secretary. For some unaccountable reason this report had been filed without having first been transmitted to our veterinarian. At this time livestock inspectors of this Bureau discovered that carabaos were dying in the municipalities of Arayat, Candaba, and Apalit. A positive diagnosis of anthrax was made in the last days of September on cases run to earth by our veterinarians and livestock inspectors. Within a short time cases were also found in the Provinces of Nueva Ecija and Bulacan. As quickly as it became apparent that anthrax was taking an epizoötic form in the valley of the Rio Grande de Pampanga all available veterinarians and livestock inspectors from other districts were rushed to that region. As many additional inspectors were appointed as the limited funds at our disposal would permit. Arrangements were made with the Philippine Constabulary to furnish more soldiers to act as quarantine guards. Unfortunately, however, the number that could be sent was very inadequate owing to the fact that so many soldiers were needed for other duty in Mindanao.

During the week ending November 10, cases of anthrax were found in Tarlac, Rizal, and Pangasinan Provinces and during the week of November 17 it was diagnosed in Bataan. In Tarlac, it was almost entirely confined to certain sections of the municipalities of La Paz and Concepcion in the valley of the Rio Chico, a tributary of the Rio Grande de la Pampanga. In Rizal, as previously stated, it was mainly confined to the low-lying area between the Pasig River and Laguna de Bay. The cases in Pangasinan and Bataan were of a sporadic nature.

The funds at our disposal being entirely inadequate it was necessary to request a special appropriation from the Philippine Legislature. Act No. 3119 was approved on November 22.

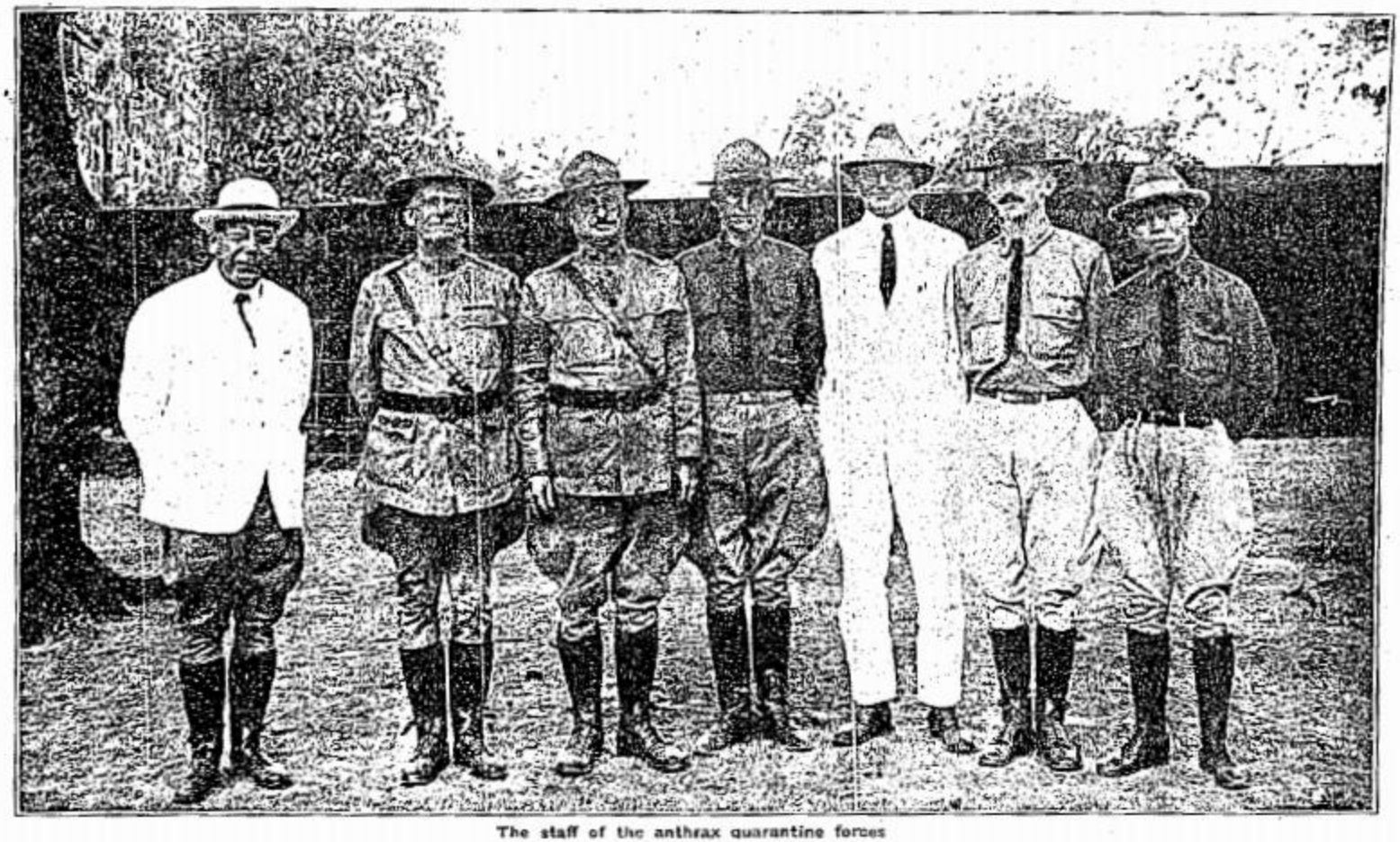
It appropriated the sum of ₱120,000 for the control of anthrax and made the Director of Agriculture responsible for the carrying out of its provisions.

Due to the fact that the number of Constabulary soldiers was inadequate for the proper policing of the infected areas, arrangements were made with the Commanding General, Philippine Department, by His Excellency, the Governor-General, for the employment of Philippine Scouts on anthrax quarantine duty. The first company of these troops reported for duty November 22, and was sent to Bulacan Province. By December 8, there were 13 companies in the field covering the infected areas of Rizal, Bulacan, and Pampanga Provinces. The Philippine Constabulary were concentrated in Bataan, Tarlac, Nueva Ecija, and Pangasinan. There were assigned to this duty 10 extra officers and 360 enlisted men. On December 31, the Philippine Scouts with 38 officers and 959 enlisted men were on anthrax quarantine duty and the Philippine Constabulary, 10 officers and 360 enlisted men.

Up to the week ending December 29, the record of the cases and deaths is as follows:

Provinces	Cases	Deaths
Pampanga	4,703	4,375
Bulacan	3,442	3,053
Nueva Ecija	1,353	1,298
Tarlac	355	318
Rizal	192	186
Bataan	49	45
Pangasinan	34	32
Total	10,128	9,307

In the Province of Pampanga cases of anthrax were found in 20 municipalities. The 9 municipalities of Apalit, Arayat, Candaba, Macabebe, Masantol, Minalin, San Luis, San Simon, and Santa Ana had 4,414 cases and 4,152 deaths, or 93.8 and 94.9 per cent of the respective totals. All of these towns with the exception of Minalin are located along the Rio Grande de Pampanga. The land embraced in the latter municipality is very low-lying and swampy. Large areas of the Candaba Swamp are comprised within the municipalities of Arayat and Candaba; Macabebe and Masantol are both in swampy sections. These four towns had 68.5 per cent of the totalnumber of cases and 73.3 per cent of the total number of deaths that occurred in Pampanga Province. Nineteen municipalities in Bulacan Province reported cases of anthrax. The five towns of Bulacan,



The staff of the anthrax quarantine forces

Calumpit, Hagonoy, Paombong, and Malolos had 2,941 cases and 2,620 deaths, or respectively 85.4 per cent and 85.7 per cent of the total number of cases and deaths. The municipality of Hagonoy alone with 1,193 cases and 1,088 deaths had 34.6 per cent and 35.6 per cent of the respective totals. These five municipalities are lowlying; Calumpit and Hagonoy also are situated on the Rio Grande de Pampanga. Out of the fifteen infected towns in Nueva Ecija the five towns of Aliaga, Cabiao, Licab, San Antonio, and Zaragoza had 85.8 per cent and 86.7 per cent respectively, of the total number of cases and deaths. Cabiao and San Antonio are in the valley of the Rio grande proper, while Aliaga, Iicab, and San Antonio are drained by the Rio Grande de Pampanga.

The mortality reached its height during the week of November 10, when there were 2,142 deaths. Since then the decrease has been very rapid. For the week ending December 29 there was a total of 69 cases and 63 deaths. With such a decided improvement in the situation it is now possible to begin planning for the progressive withdrawal of the companies of Philippine Scouts at an early date.

Forty thousand doses of anti-anthrax serum and spore vaccine have been ordered from the United States. The first 15,000 doses have already arrived and vaccination has begun in the infected regions of Rizal Province where 523 carabaos have been vaccinated. The idea infected districts as well as the new animals that may be brought in to replace those that have been lost. It is estimated that between 80,000 and 100,000 animals will have to be vaccinated.

A limited number of sporadic cases of anthrax have occurred in Laguna, the province which was visited by an epizoötic in 1922. A small outbreak has just been reported from Merida, Leyte, which began about the middle of December. It was investigated by one of our veterinarians from Cebu, who states that the losses are heaviest in the low-land barrios.

Septicemia hemorrhagica.—Outbreaks of slight importance were recorded in Cebu, Bohol, Camarines Norte, Agusan, and Misamis.

Contagious bovine pleuro-pneumonia.—A few cases were discovered on post-mortem examination of Australian cattle at the Sisiman slaughter house.

Surra.—Outbreaks of surra were reported in the Provinces of Abra, Albay, Laguna, Camarines Norte, Camarines Sur, Isabela, and Nueva Vizcaya but were not of serious consequences.

Glanders.—Few cases were reported this year.

Contagious abortion.—None reported.

Foot-and-mouth disease.—Persistent lingering out breaks were reported in Lanao and Bukidnon, causing but slight losses. Several shipments of cattle and carabaos from French Indo-China arrived infected with this disease.

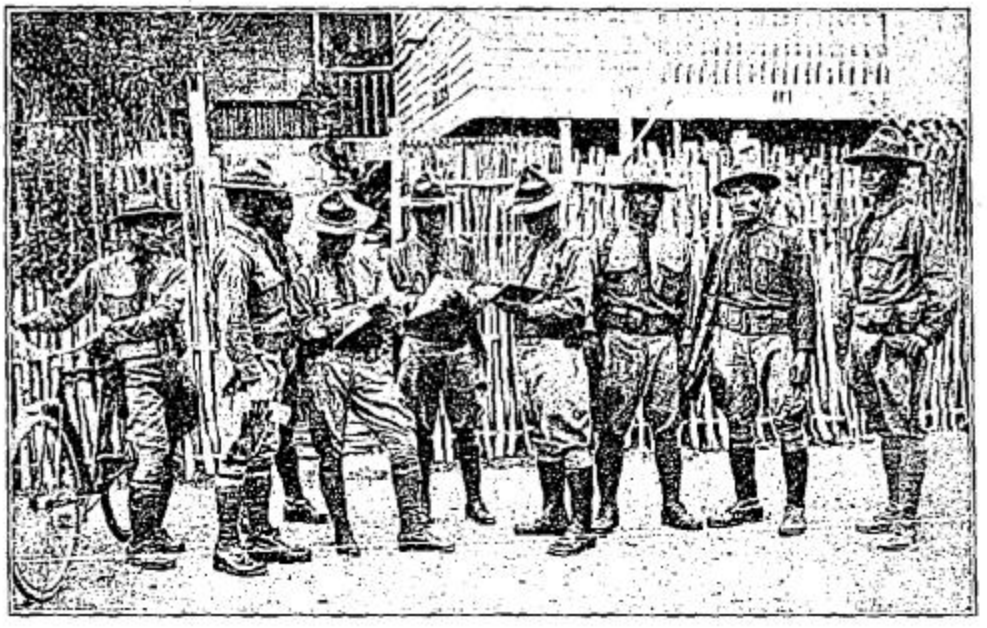
ILOILO QUARANTINE STATION

During the year, this station received 3,326 carabaos and 25 cattle from French Indo-China, as compared with 777 carabaos imported last year. No improvement was done during the year either on the grounds or buildings of the station. In some of these sheds the bamboo frames are already rotten as well as the nipa roofings so that a general repair is necessary.

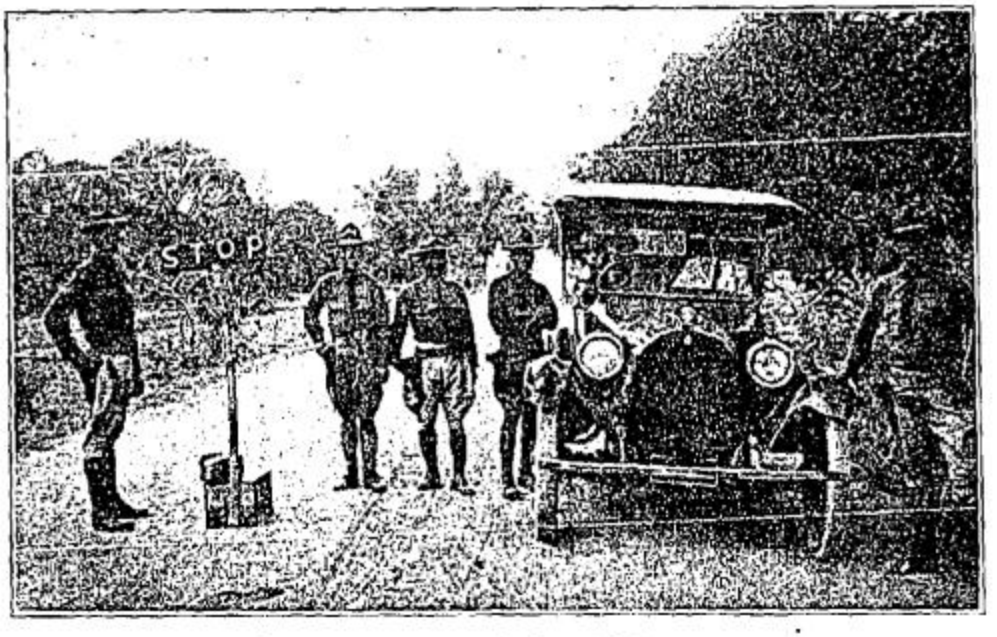
SISIMAN MATADERO

During the year, 4,814 head of cattle were received at the Sisiman stockyards and matadero—all from Australia. Regular shipments were received during the months of January to June, inclusive. Cases of anthrax appeared in four shipments of cattle after landing at Sisiman. The shipments arrived as follows: one in the latter part of April, two in May and one in the first part of June. The earliest appearance of a positive case was three days after landing in the shipment that arrived in May 22. The voyage from Northern Australia to Sisiman occupies from nine to ten days. Orders were issued suspending further shipments until such time as the origin of the disease could be determined and steps taken to prevent its recurrence. It was at first suspected that the infection originated in Australia. After a thorough investigation it was determined that the infection was due to the Philippine rice-straw with which the cattle were fed while in transit and after their arrival at the stockyards. On November, one shipment was imported with all due precautions as to feed that is, imported American hay being used, but the disease broke out just the same the fifth day after arrival. This was attributed to soil infection, and it was decided to suspend all shipments until such time as the stockyards can be put into such condition as to prevent further infection from the soil.

The pumps and piping connecting with the Bureau tanks at the stockyards were taken over by the Government toward the end of the year.



(a) Studying the plans preparatory to going to their stations



(b) Inspecting a car proceeding from infested areas